Pool Operator's Course:

March 20th, 2013

Hood River County Health Department

Environmental Health Office

541-387-6885

Ian G. Stromquist, REHS

- **Registered Environmental Health Specialist**
- **Also:**
  - **Certified Public Swimming Pool Inspector**
    - *Oregon State Public Pool and Tourist Facility Program*
  - **Certified Life Guard (*expired*)**
  - **Pool Operations Tech & Swimming Instructor (1999 – 2000)**

Hood River County Health Department

- **541-387-6885**
- **1109 June St., Hood River, OR, 97031**
- **ianstromquist@co.hood-river.or.us**

County Program Objectives:

- Pool Operator Education
- Increased Pool Safety & Compliance in Hood River County
  - ***No Communicable Disease Outbreaks!***
  - Reduction in drowning risk
  - Improved pool water quality
  - Improved surveillance for safety hazards

It’s About The Kids!

Student Learning Objectives:

- Understanding pool operator's responsibilities.
- Understanding the roles of management & staff
- Identifying mechanical components of a swimming pool.
- Understanding water quality management.
- Recognizing safety, supervision and risk management issues.
- Awareness of Oregon Administrative Rules (OAR: 333-60-0000 & 333-062-0000).

Health Issues in Pool Operation

- 7.4 Million swimming facilities in USA.
  - Very popular recreation & leisure activity
    - http://www.cdc.gov/nceh/ehs/Docs/JEH/2006/May_2006_Otto.pdf
- Drowning is 2nd leading cause of death among children in the USA.
    - http://www.cdc.gov/HomeandRecreationalSafety/Water-Safety/waterinjuries-factsheet.html
- Communicable Diseases.
- Physical Hazards & Injuries
- Water Quality

http://www.cdc.gov/healthywater/swimming/

This is a really big deal at CDC…

CDC Home

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

SEARCH

A-Z Index A B C D E F G H I J K L M N O P Q R S T U V W X Y Z #

Healthy Swimming/Recreational Water

For Specific Groups

- Model Aquatic Health Code Reviewers
- Public
- Public Health Professionals
- Medical Professionals
- Aquatics Staff
- Travelers
- En Español
- Outbreak Response

Publications, Data, & Statistics

MMWR & EID Reports, References, Surveillance, Outbreaks

Healthy Swimming Resources

Health Promotion Materials

Announcements

Newsroom, Features, & Observances

Training & Education

Swimming and other water-related activities are excellent ways to get the physical activity needed for a healthy life, and millions of people enjoy oceans, lakes, rivers, pools, and spas each year. However, it is important to be aware of ways to prevent water-related adverse health events, such as sunburn and other injuries, drowning, and recreational water illnesses (RWIs). CDC's Healthy Swimming program provides information for the public and health professionals (for example, outbreak response toolkits and the Model Aquatic Health Code) on a variety of subjects.

Healthy Swimming & Recreational Water Topics

Pools & Hot Tubs
Model Aquatic Health Code, Design, Operation, Disinfection...

Oceans, Lakes, & Rivers
Beach Monitoring, Water Quality Indicators...

Recreational Water Illness
RWI Basics, Education & Prevention Materials, State Resources...

Injury & Skin Cancer
Drowning, Boating, Sun Protection...

Email page link
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What's this? Submit

Contact Us:

Centers for Disease Control and Prevention
1600 Clifton Rd
Atlanta, GA 30333

800-CDC-INFO
(800-232-4636)
TTY: (888) 232-6348

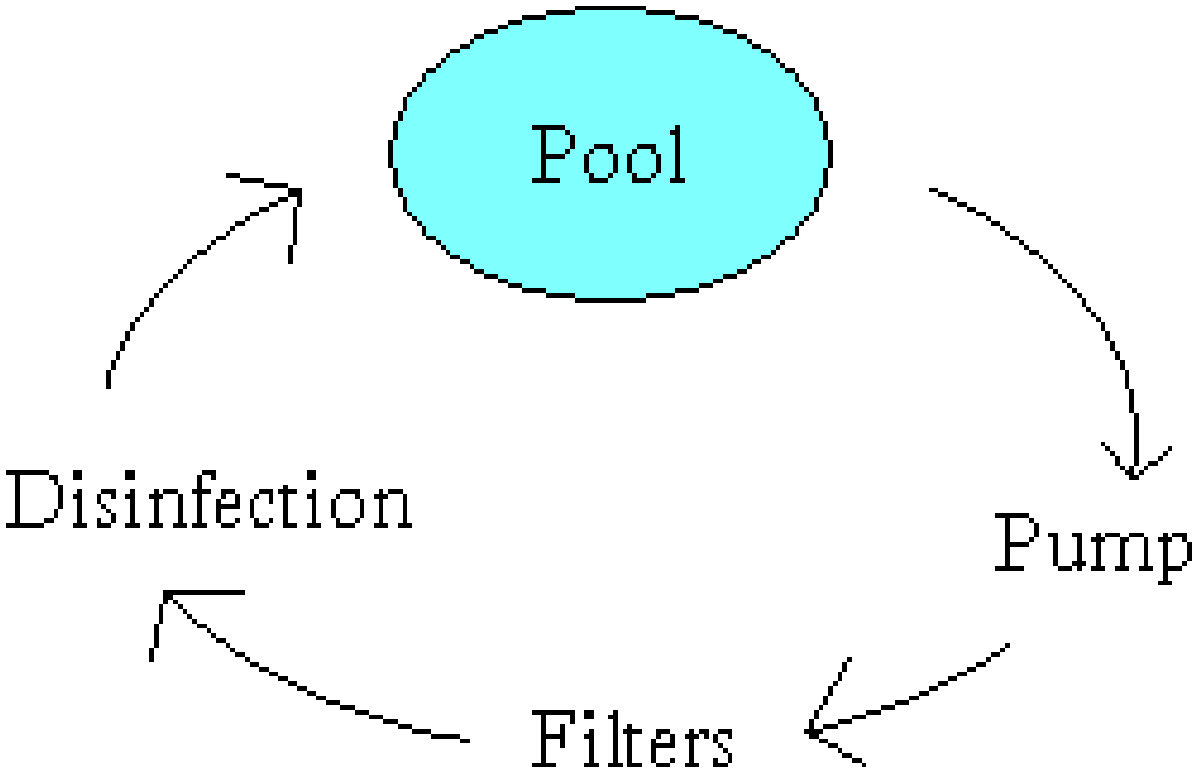
Contact CDC-INFO

For more information, please contact us at healthyswimming@cdc.gov

Swimming Pool Anatomy 101

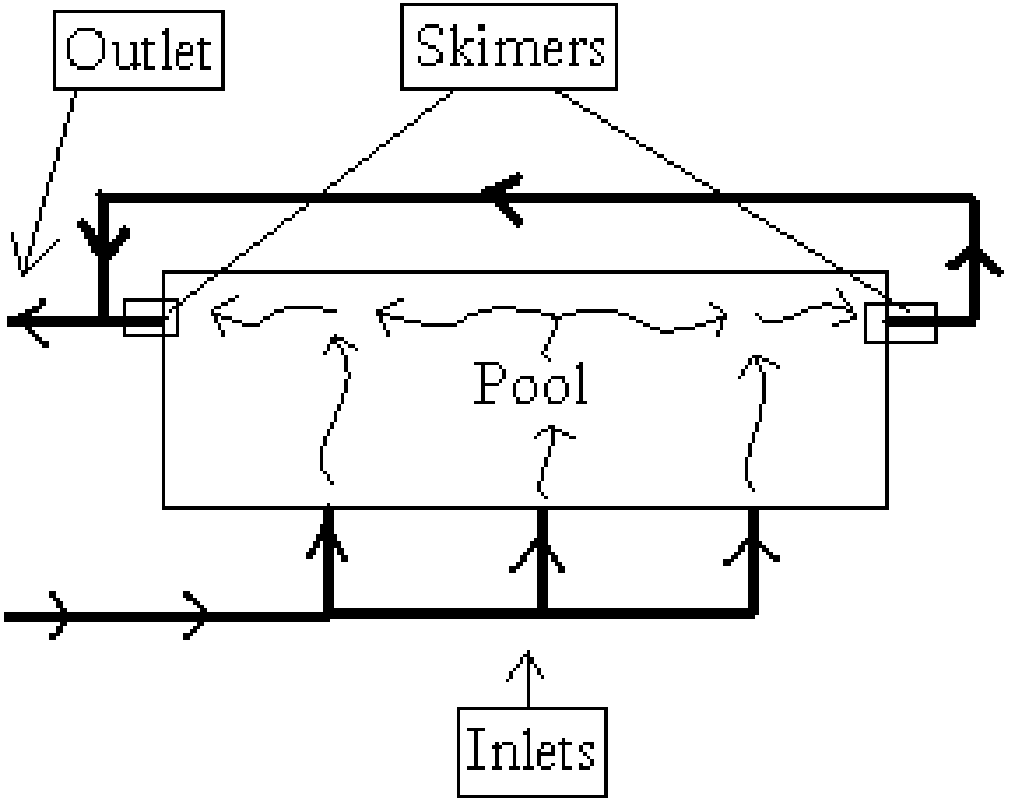
So, where does that pipe go?

Pool Circulation:

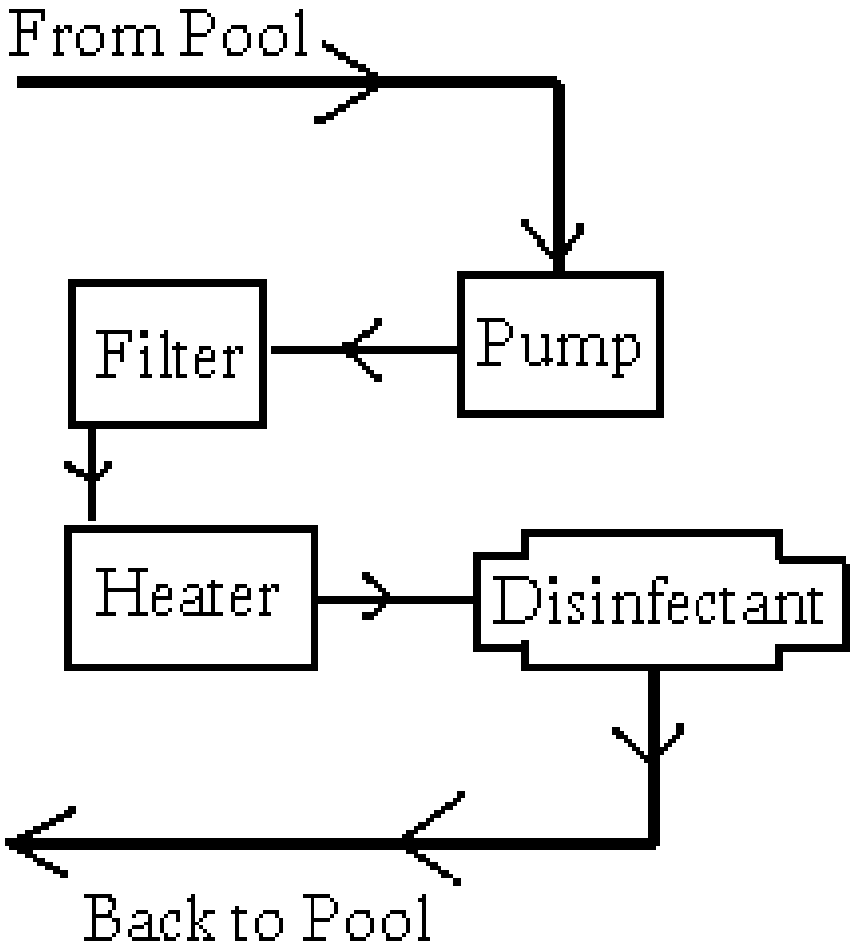


Don’t Forget: Air Circulation!

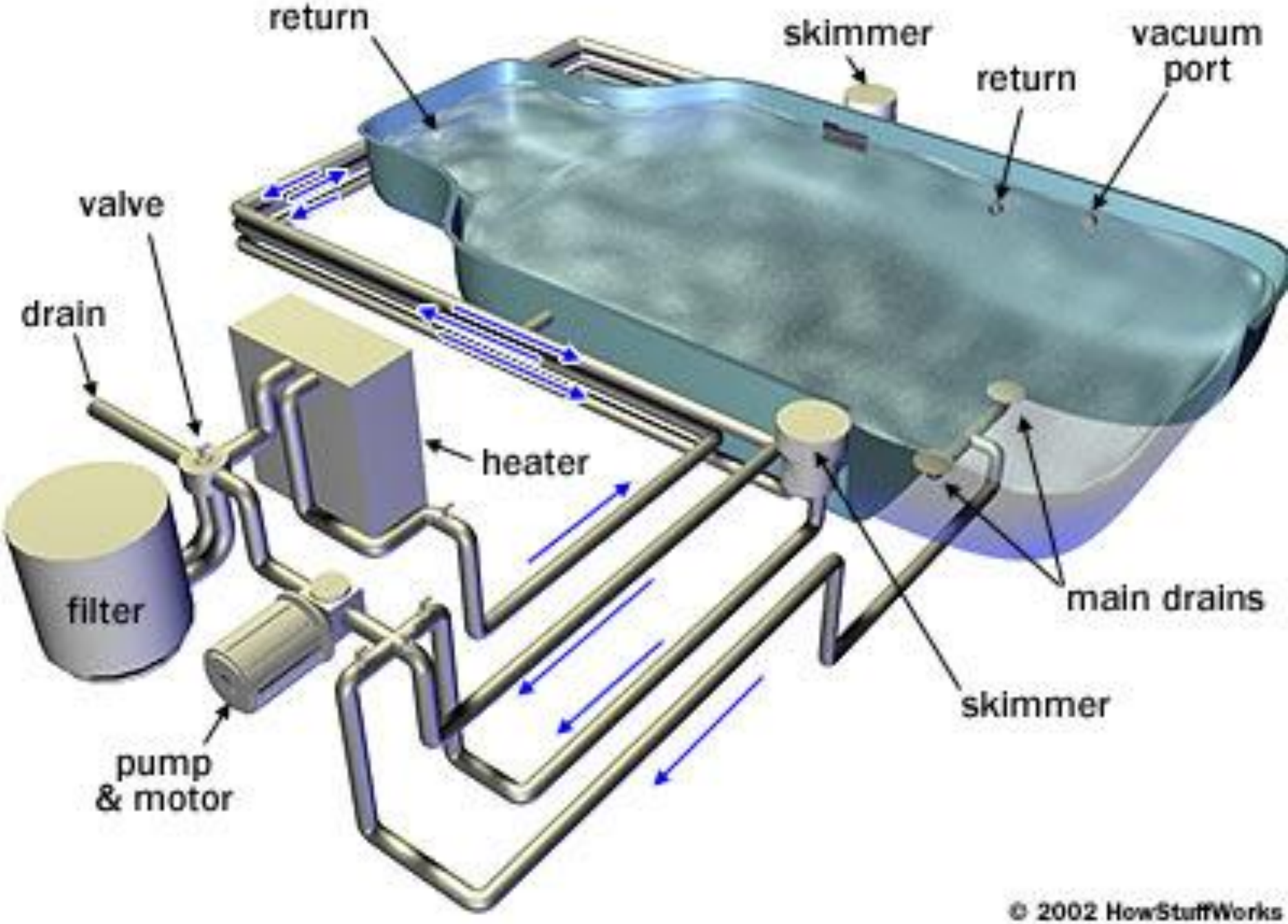
Water Flow in the Pool



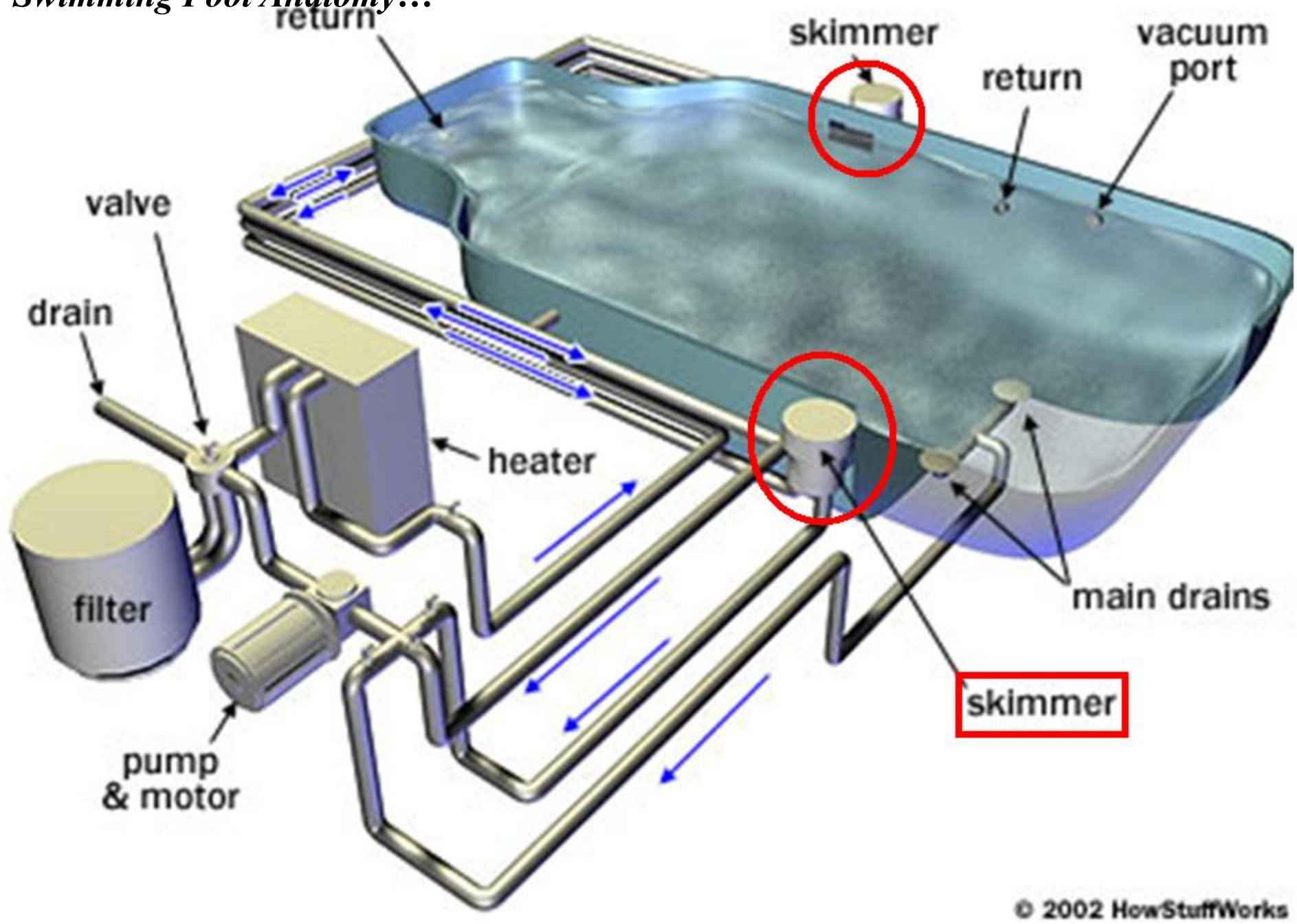
Water Flow in the Pump Room



Swimming Pool Anatomy…



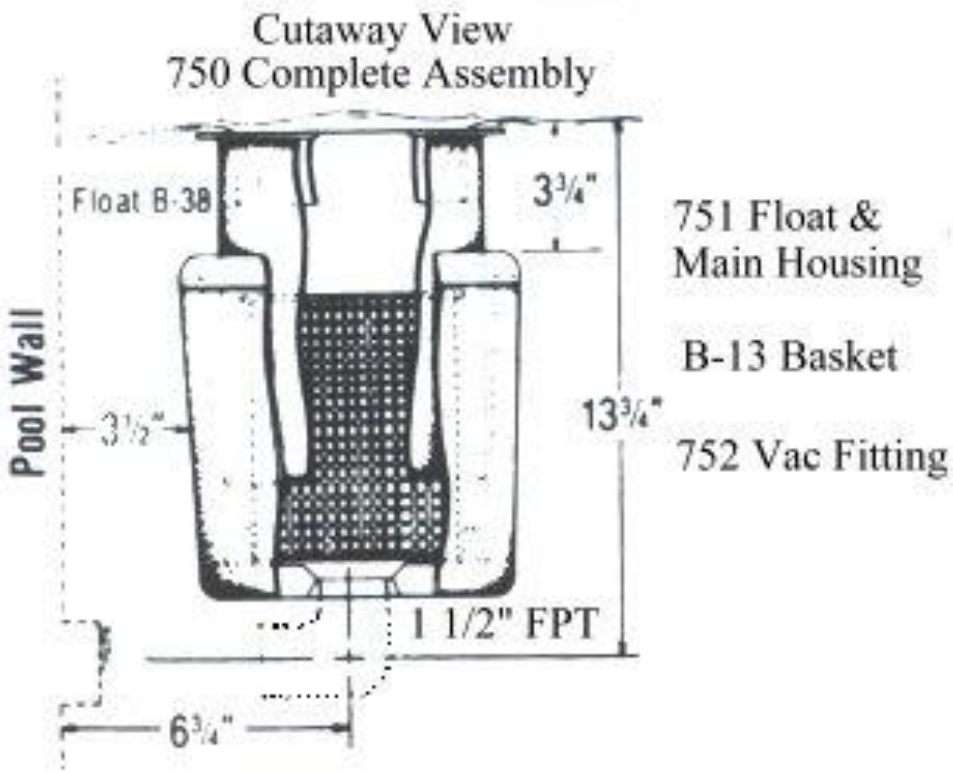
Swimming Pool Anatomy…

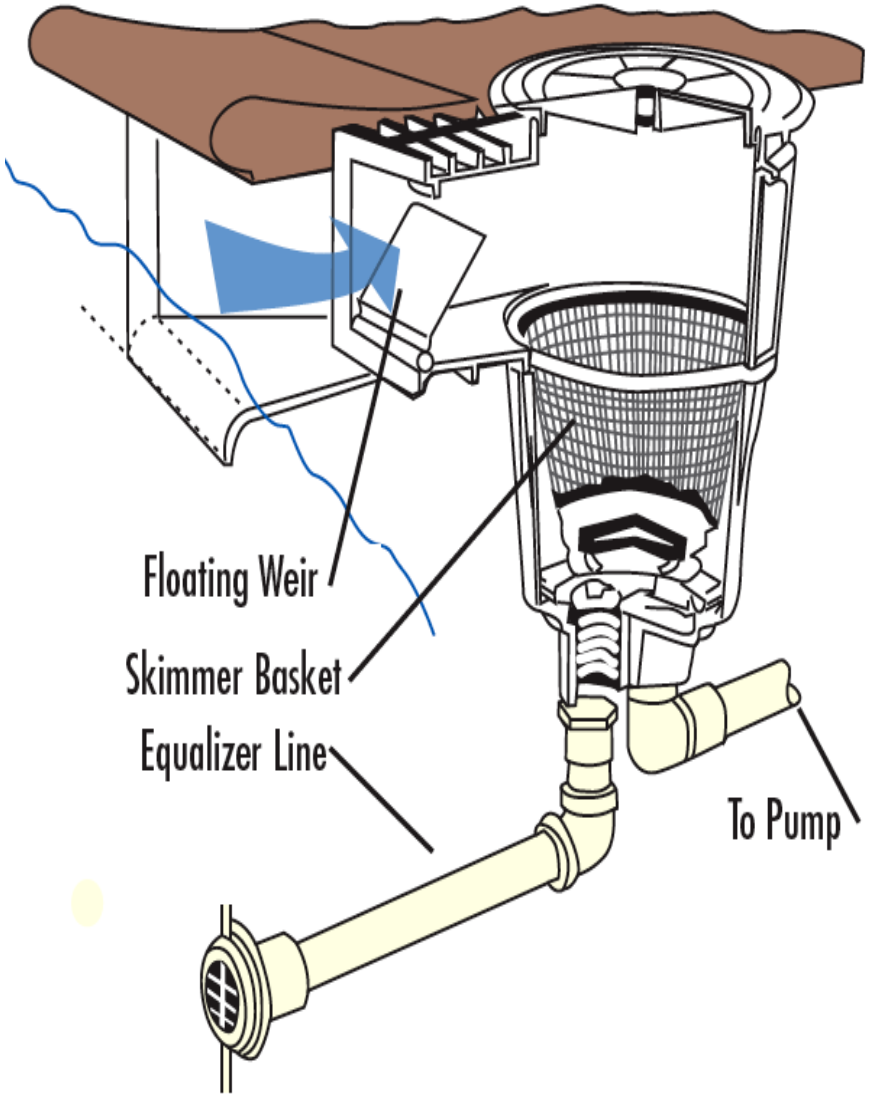


Outlet - Skimmers

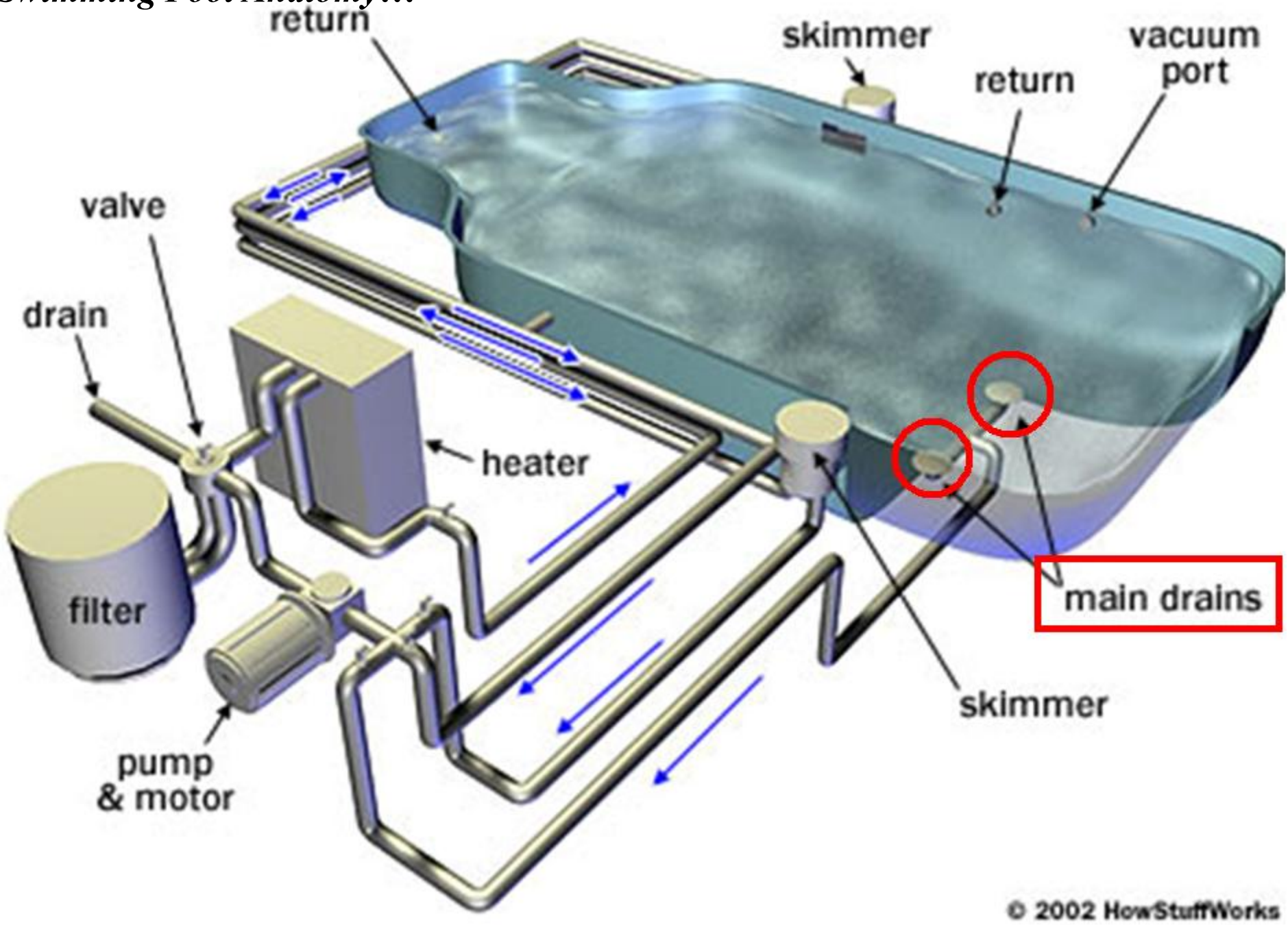
- **Skims filth from the surfaces of the water**
- **Essential for effective filtration**

Outlet - Skimmers



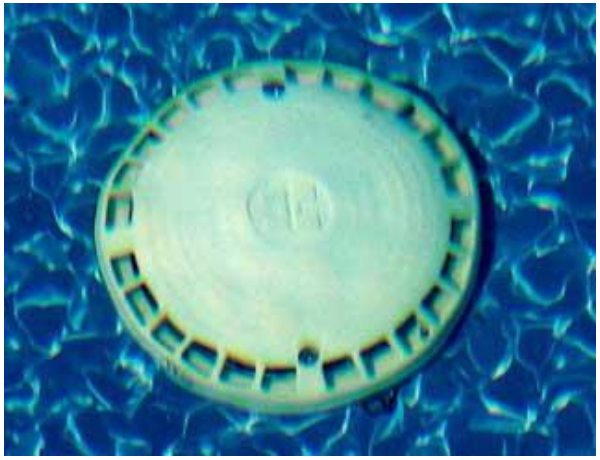


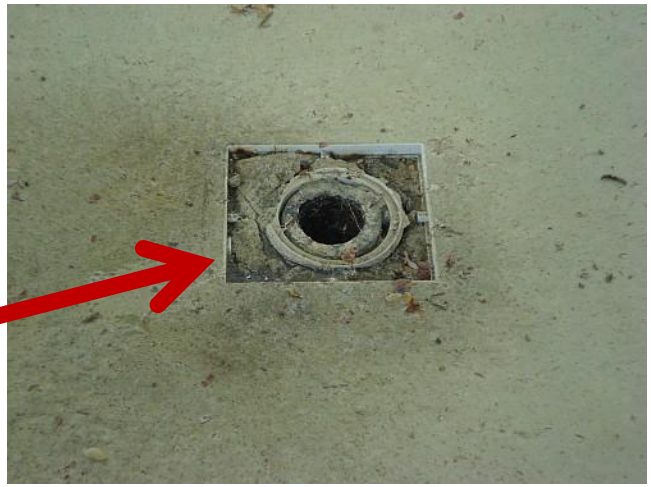
Swimming Pool Anatomy…



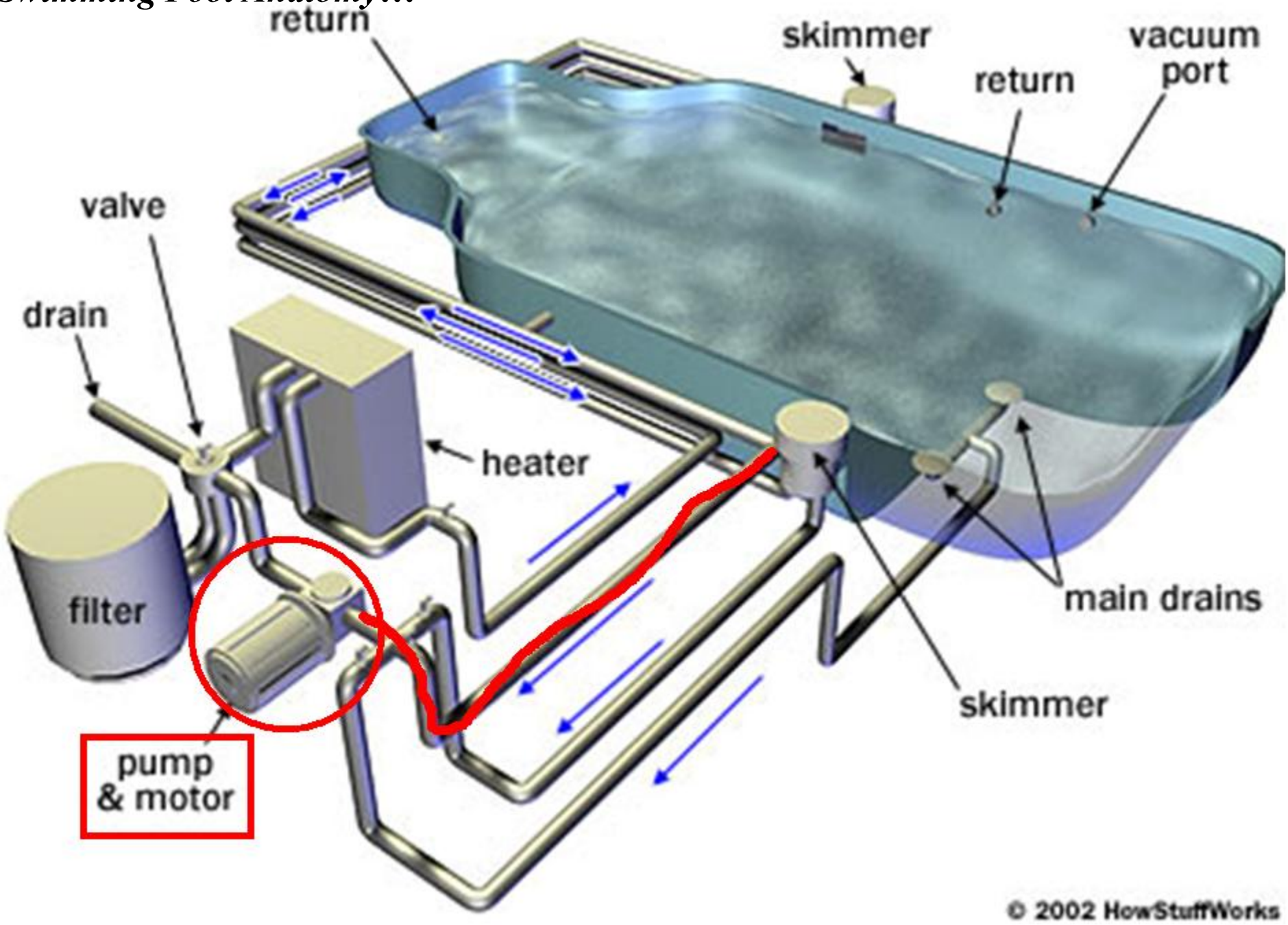
Outlet – Main Drain

- Increase total flow through the filter.
  - Use only if necessary to achieve required flow rate.
- Used to drain the pool
- *Virginia Graeme Baker Act?*





Swimming Pool Anatomy…

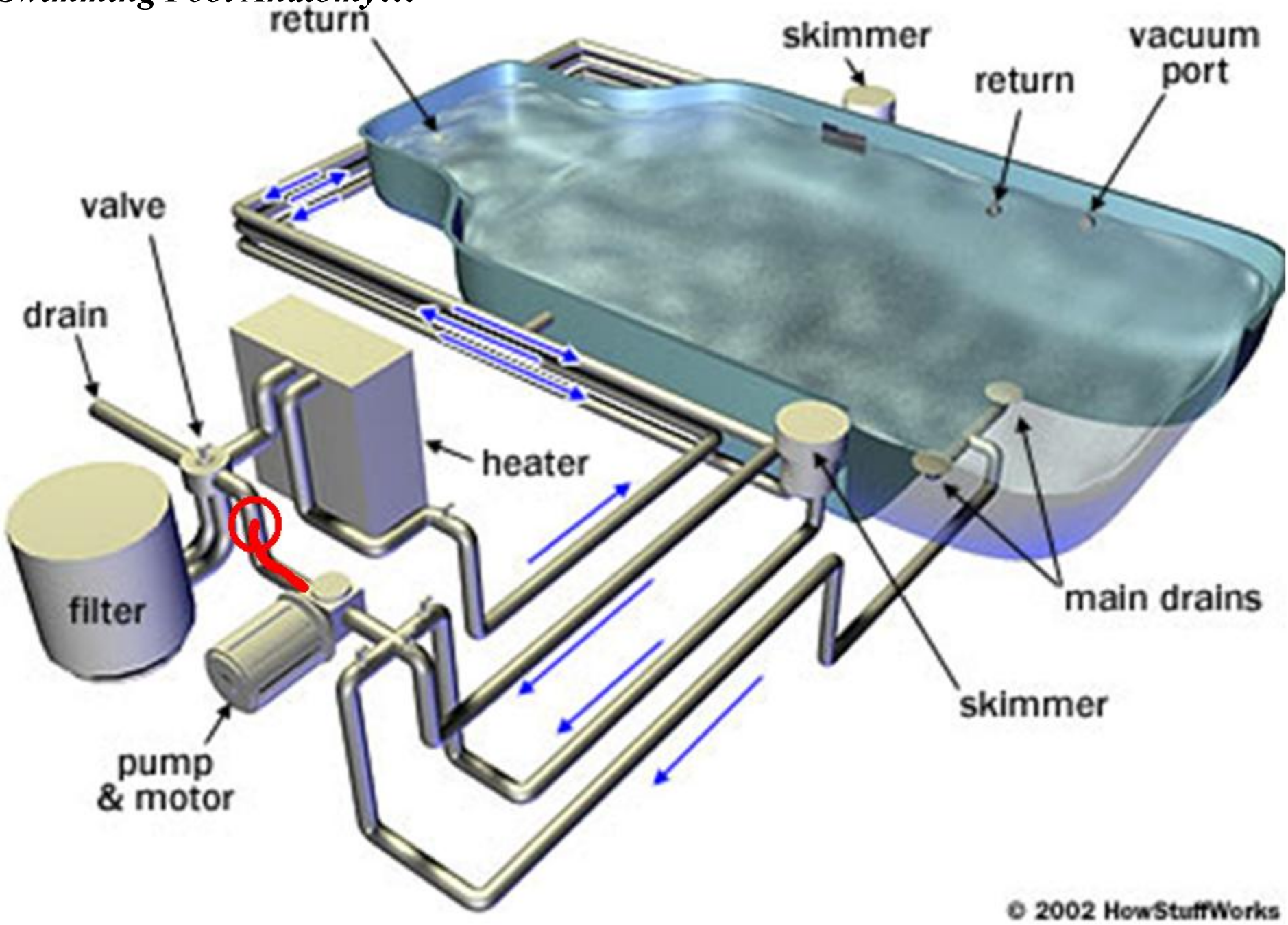


Water Pump

- Components
  - Hair & Lint Strainer
  - Motor
  - Pump assembly

- Maintains Circulation & Pressure

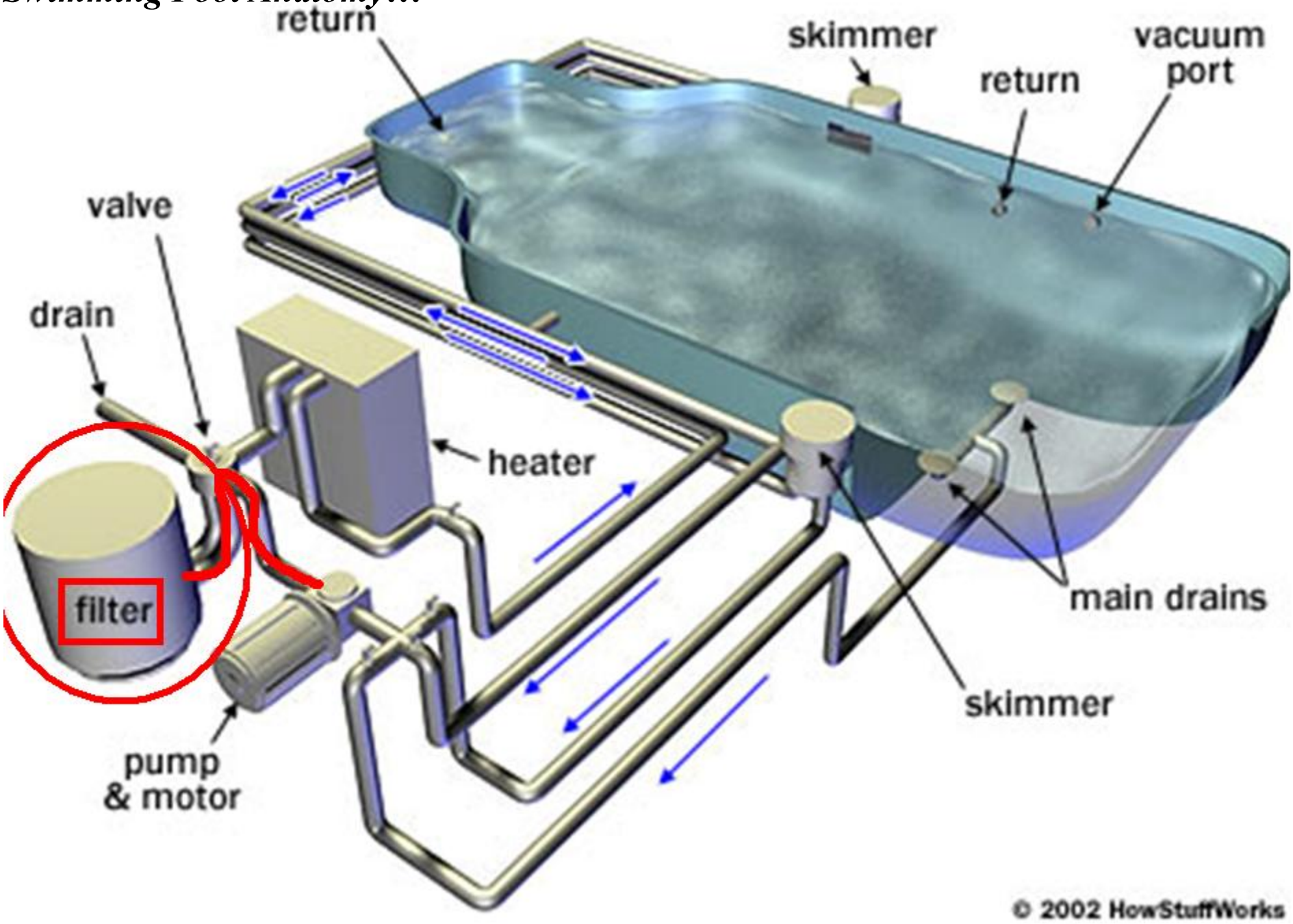
Swimming Pool Anatomy…



Pressure Gauge

- Measures ‘Pressure per Square Inch’ (PSI).
- Install before and after the filter.
  - Many filters have a gauge incorporated.
- Pick a straight section of pipe.
  - Pick an area where it is easy to read.

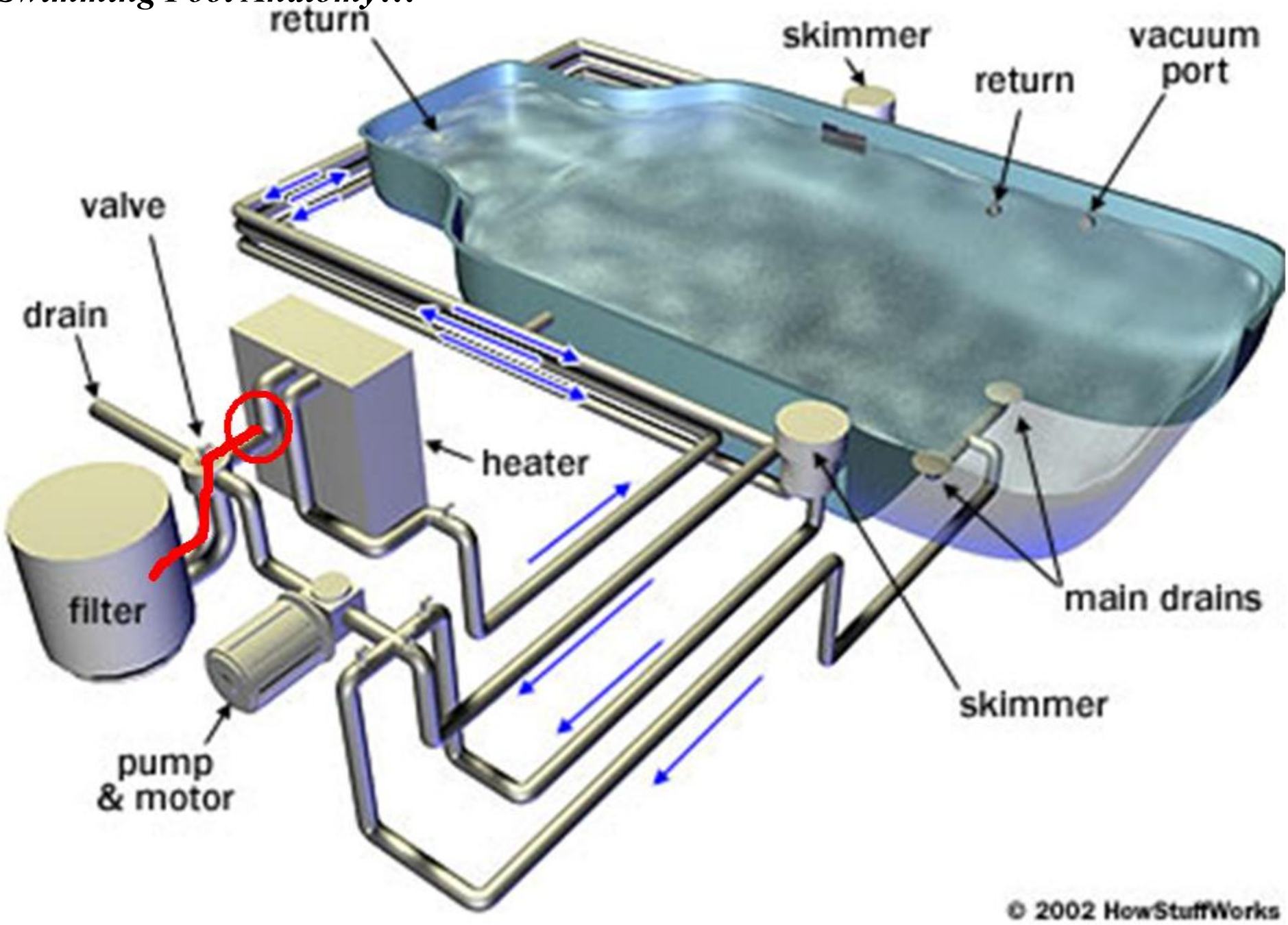
Swimming Pool Anatomy…



Filter

- Types:
  - Sand Filters
  - Diatomaceous Earth (DE) Filters
  - Cartridge Filters

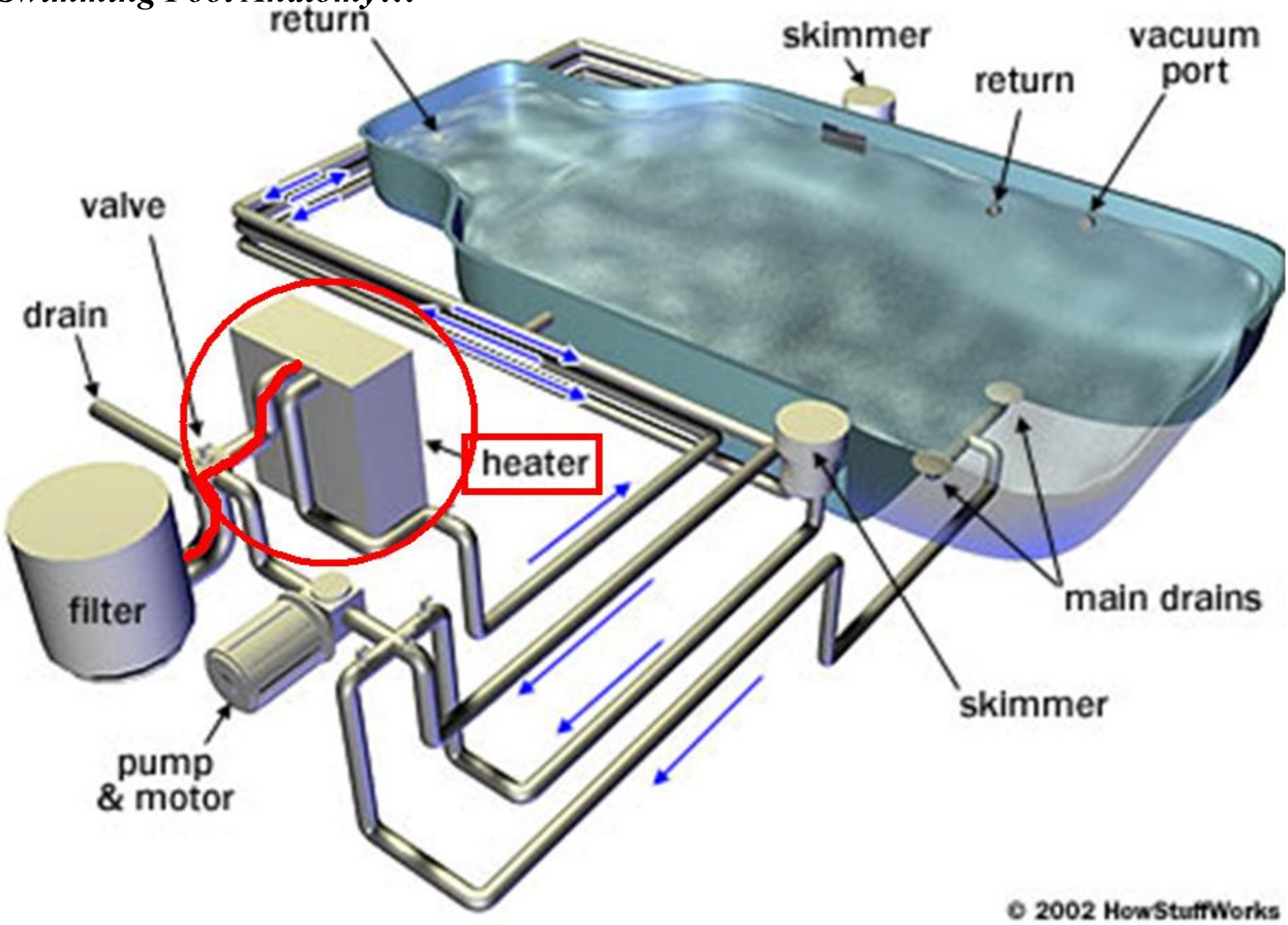
Swimming Pool Anatomy…



2nd Pressure Gauge

- Measures Pressure after the filter.
  - Lets us know when to back-wash the filter.

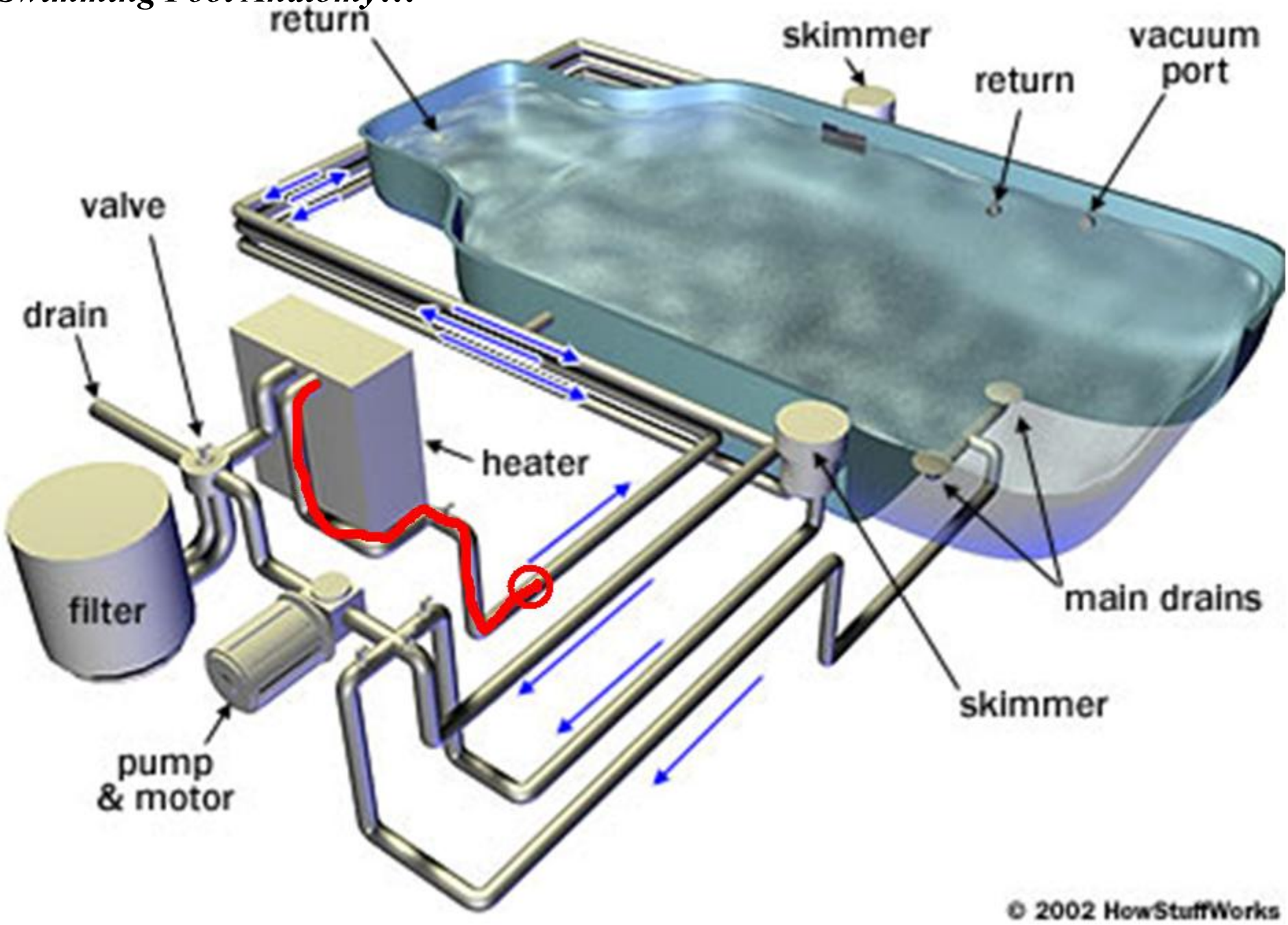
Swimming Pool Anatomy…



Water Heater

- Never higher than 104ºF
- Regular maintenance
  - Controlling water balance.
    - Is the water ‘scaling’ or ‘corrosive’?

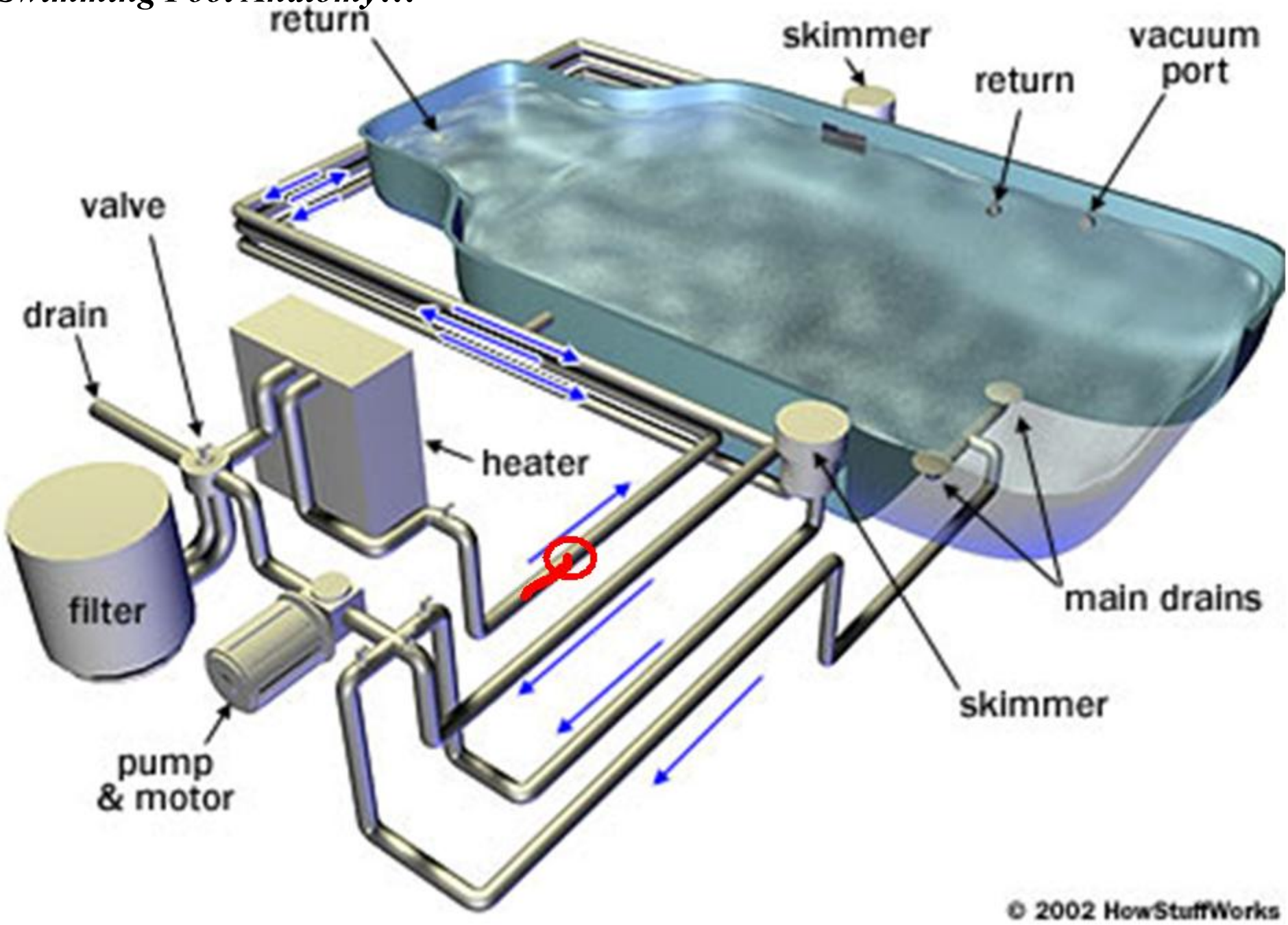
Swimming Pool Anatomy…



Flow Meter

- Measure gallons per minute (GPM)
- Install on a straight section of pipe
  - Bends disrupt flow
- Ensure:
  - General Use Pool
    - 6 hour turnover
  - Limited Use Pool *(small)*
    - 8 hour turnover

Swimming Pool Anatomy…



Disinfection System

- **Must be equipped with an automatic chemical feeder.**
  - Fine feed rate adjustment
  - Capable of feeding 1 pound of Cl^- per 15,000 gallons of pool water per 24 hours
  - NSF compliant

OAR: 333-060-0150(2)

OAR: 333-062-0125(2)

You may also have…

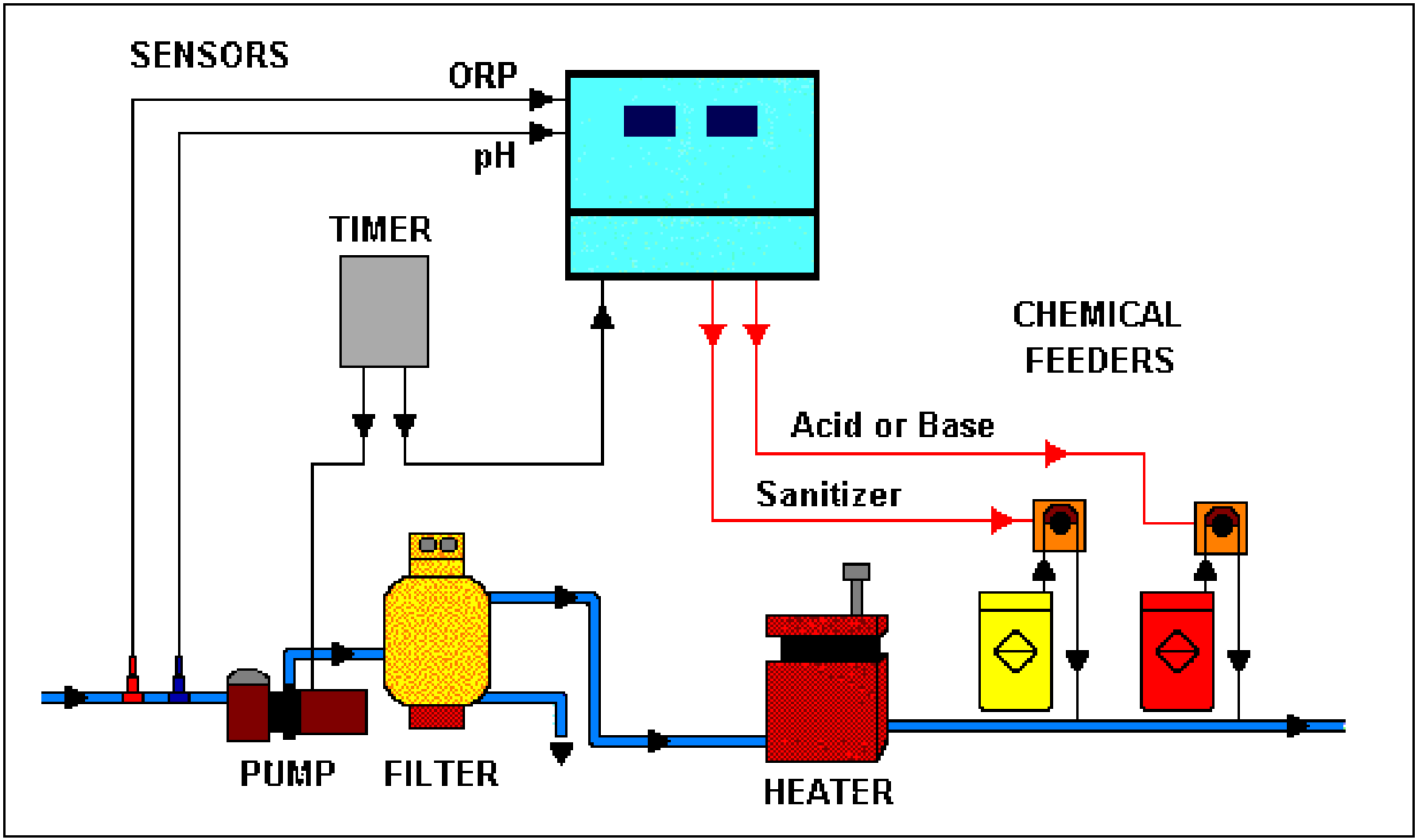
UV Light

- **Destruction of Chloramines**
- **Kills some pathogenic organisms**
- **Not a replacement for chemical disinfection**

Automatic Monitoring

- **ORP**
  - Oxidation Reduction Potential
- **Continuous reading devices**
  - Must measure both:
    - pH & Chlorine/Bromine
    - Exclude some manual chemical monitoring requirements

Automatic Systems



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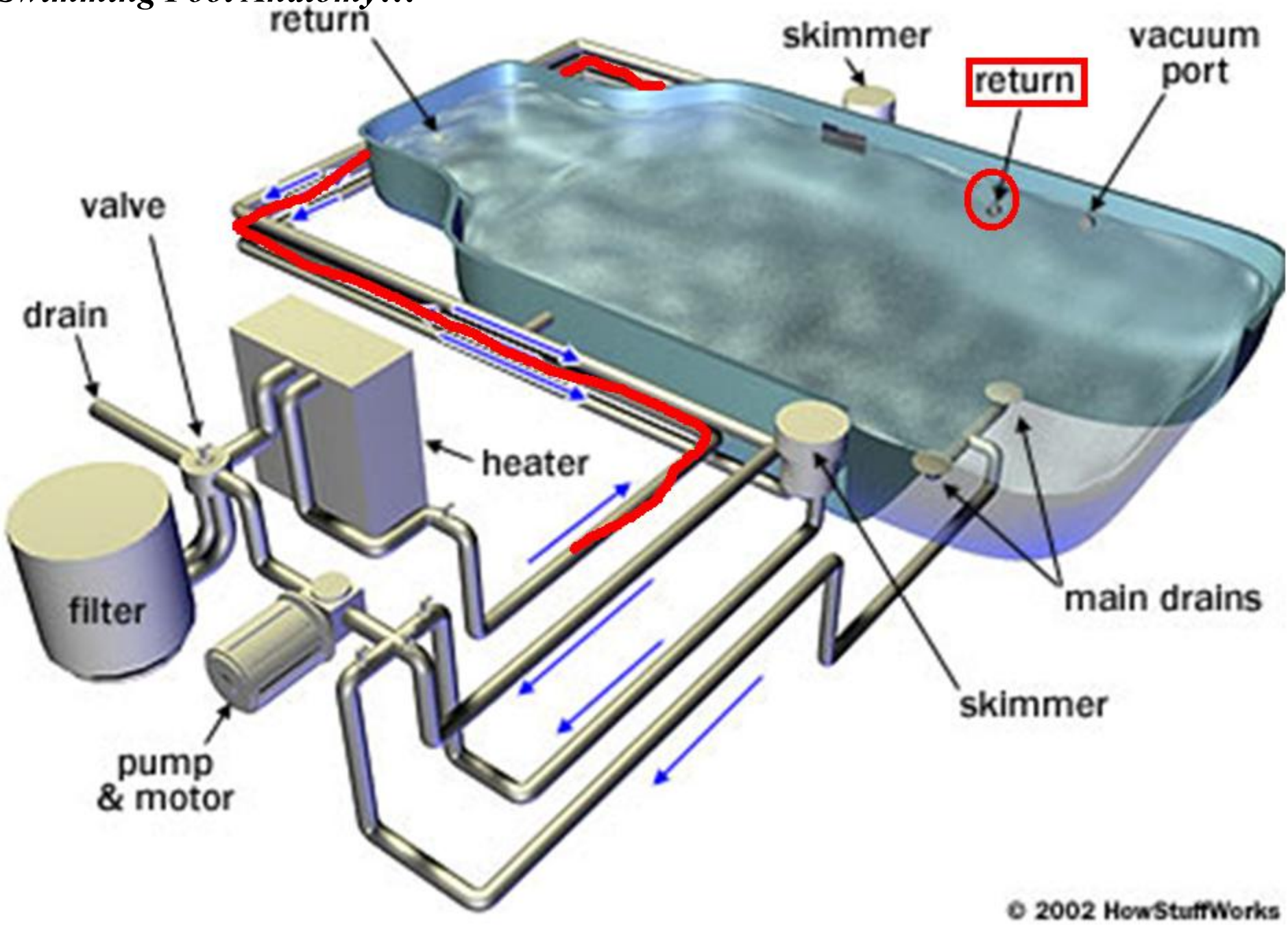
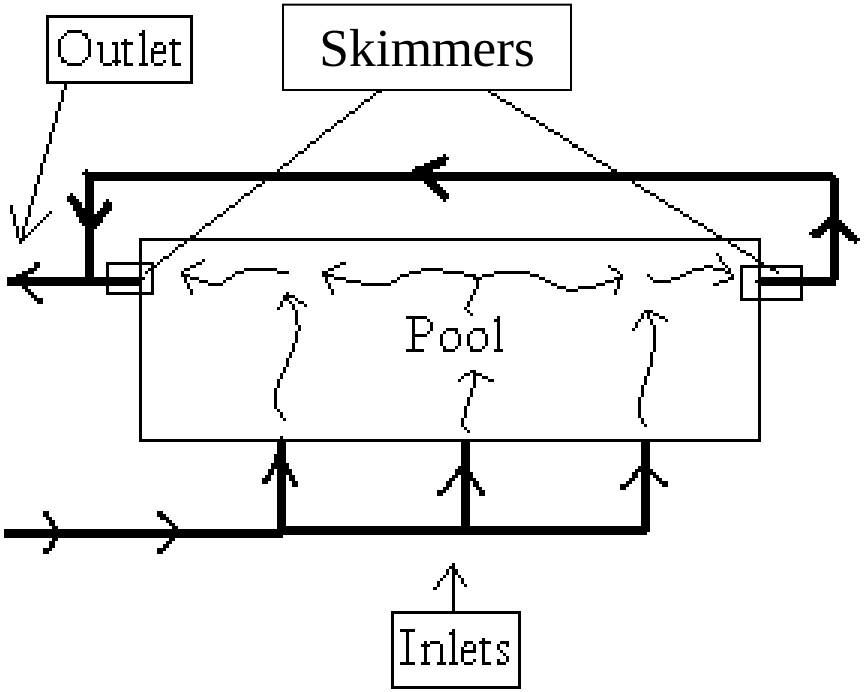


Inlet

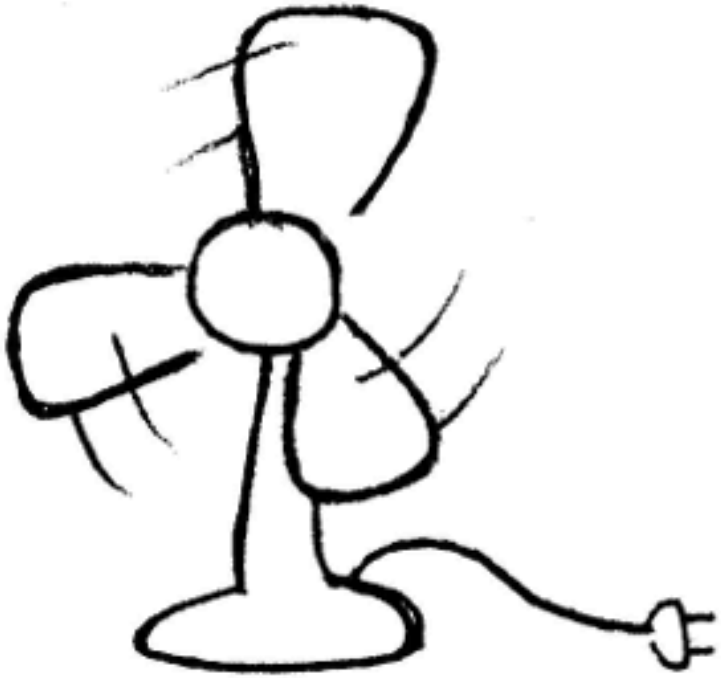
- **Brings clean treated water back to the pool**



Air Circulation

Air circulation including:

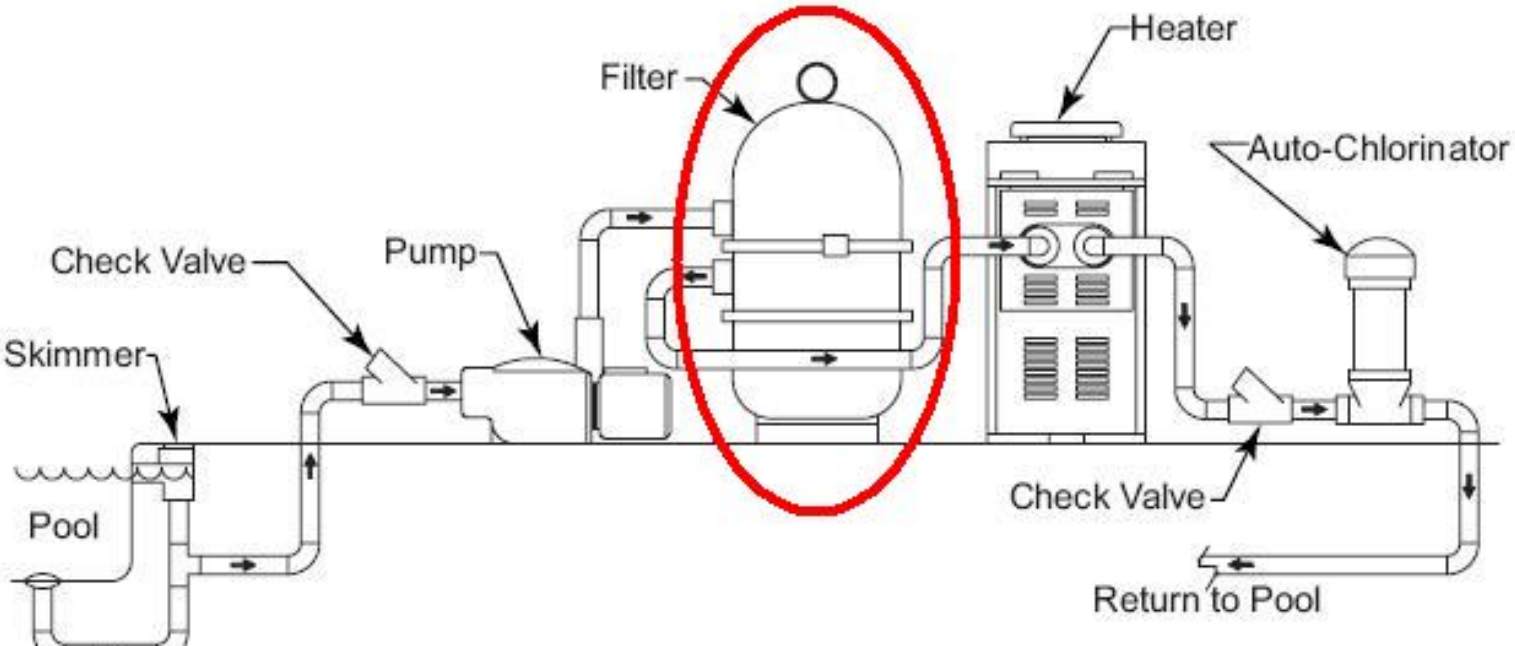
- **Why is it important?**
  - **Regulating humidity,**
  - **Negative pressure,**
  - **Poor indoor air quality and the affect on patrons and staff, and**
  - **Air change and energy efficiency.**



Any Questions?

Filtration

An examination of different filtration types.

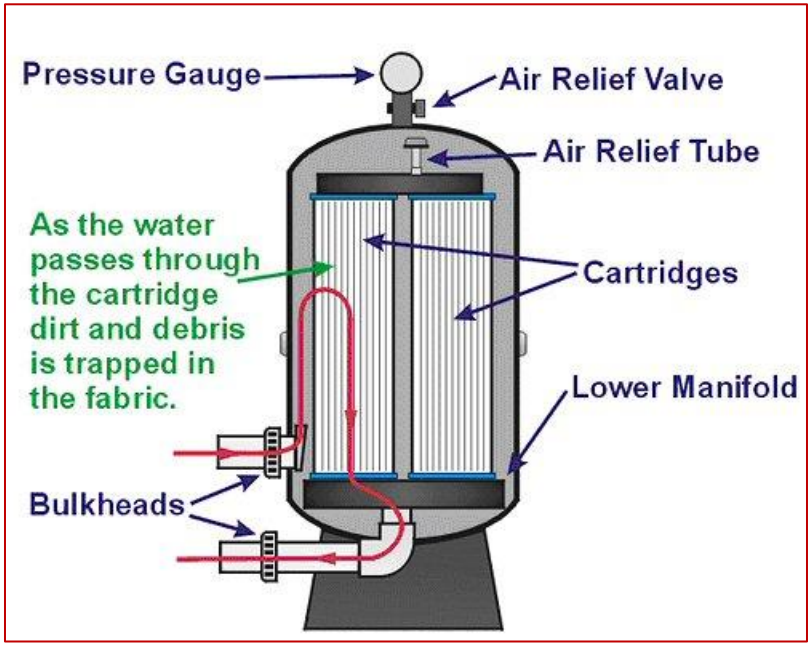


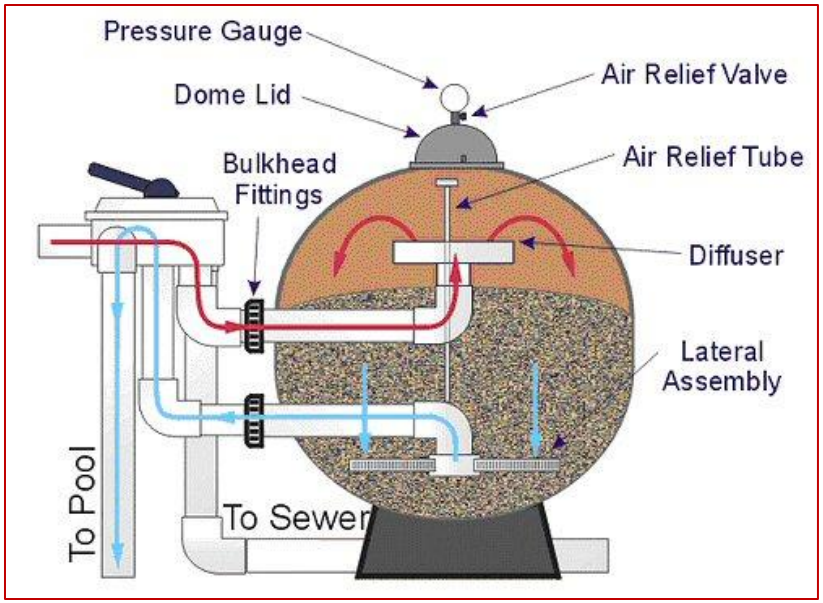
Filtration

- **Why Do we filter the pool water?**
  - To screen and trap dirt & filth.

- **Filter Capability:**
  - Sand filtering capability = 20 – 25 microns
  - Cartridge filtering capability = 5 – 10 microns
  - DE filtering capability = 1 – 3 microns

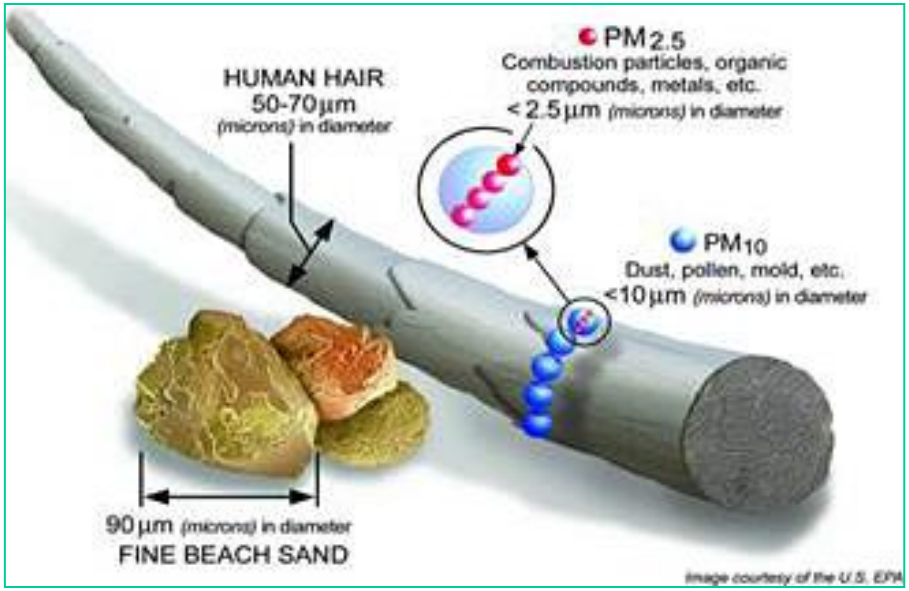
- **Germs of Concern:**
  - Average bacteria = 2 microns
  - Pseudomonas = 1-5 microns
  - Cryptosporidium ("Crypto") = 1 – 4 microns



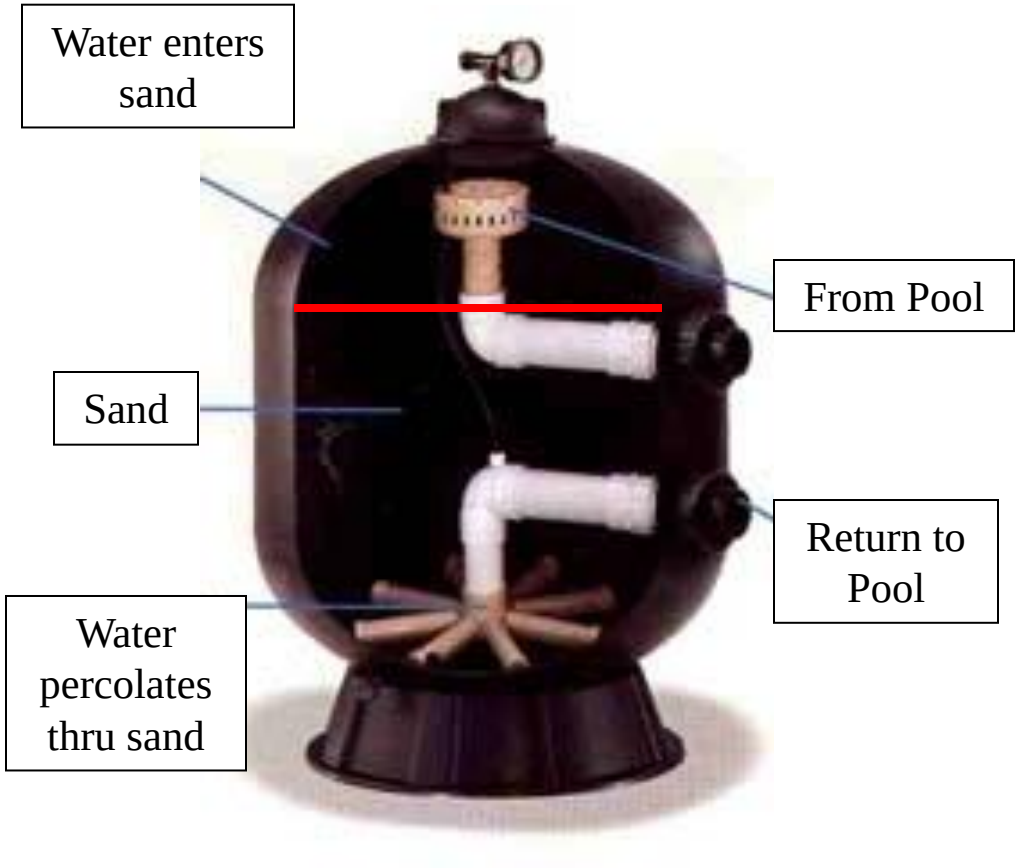


Micron?

- **Size Matters:**
  - Grain of table salt = 90 – 100 microns
  - Human hair = 70 microns
  - Visible to the naked eye = 35 microns
  - Sand filtering capability = 20 – 25 microns
  - Talcum powder = 5 – 10 microns
  - Cartridge filtering capability = 5 – 10 microns
  - Red blood cells = 8 microns
  - Average bacteria = 2 microns
  - Pseudomonas = 1-5 microns
  - Cryptosporidium ("Crypto") = 1 – 4 microns
  - DE filtering capability = 1 – 3 microns



Rapid Sand Filter

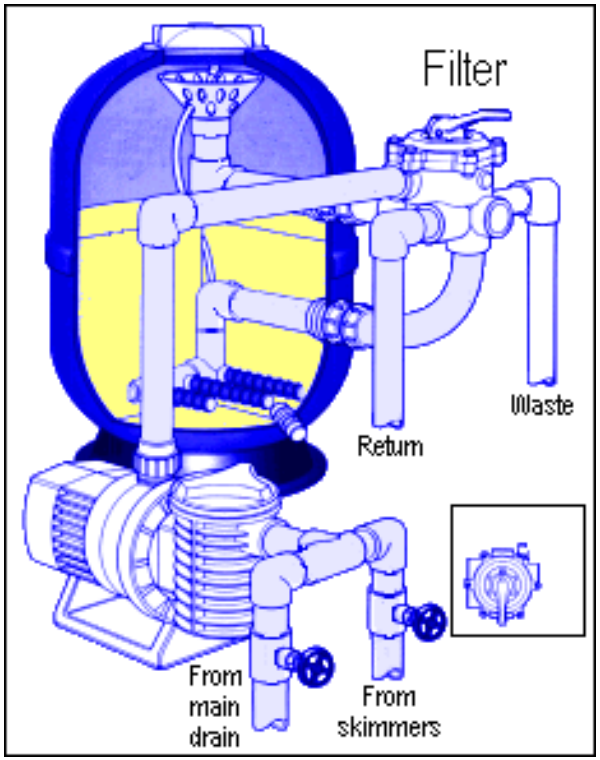


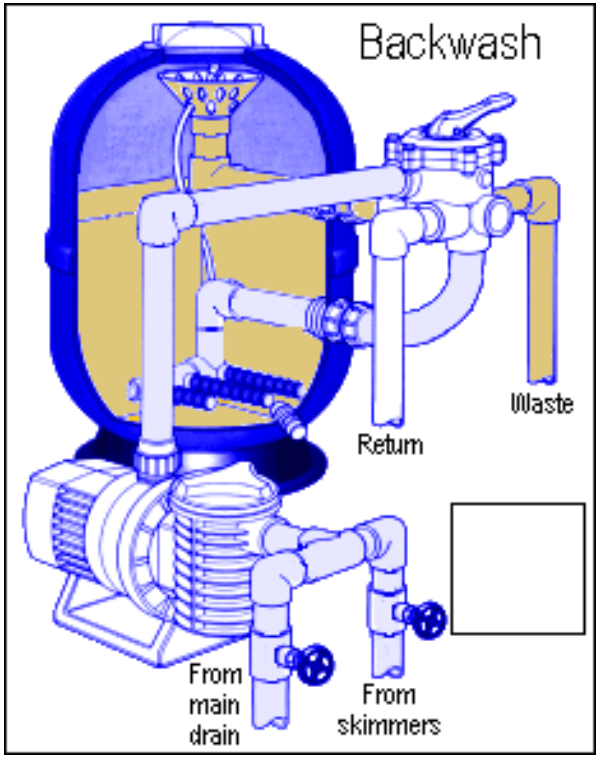
Sand filtering capability = 20 – 25 microns

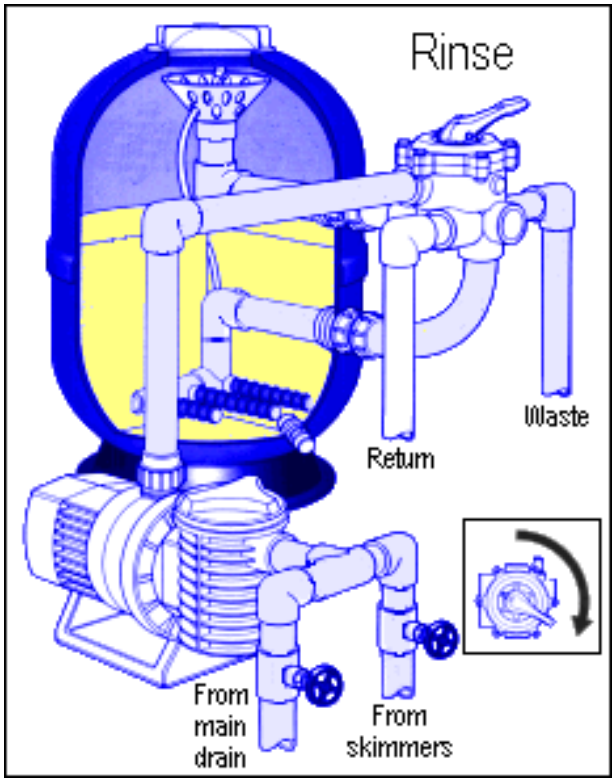
Rapid Sand Filter

- Concepts
  - Sand filter uses the entire depth for filtration
  - Mud-balls
  - Channeling / short circuit
  - Calcification
  - Sand replacement

Filtration


Filter
Waste
Return
From
main
drain
From
skimmers


Backwash
Waste
Return
From
main
drain
From
skimmers


Rinse
Waste
Return
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main
drain
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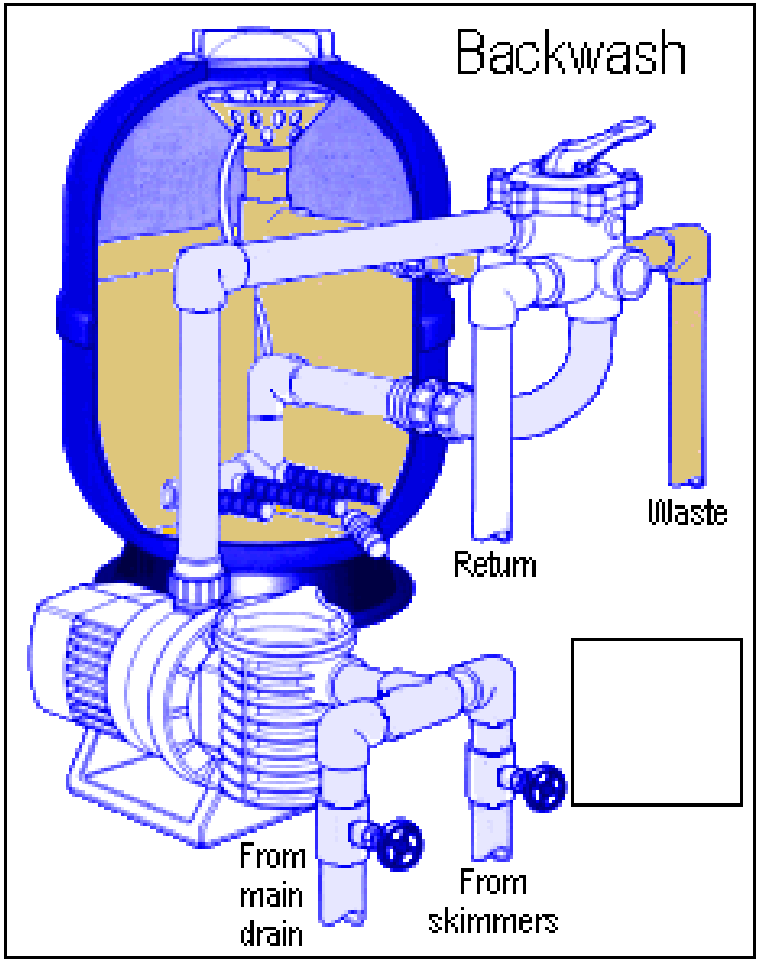
skimmers

Backwash



Backwash: Why?

- Cleaning the dirty filter media
  - Whenever the flow of water becomes restricted through the filter.
    - Because of an accumulation of dirt.
  - Usually occurs when the pressure differential exceeds 15 to 20 PSI.
- Do not backwash because it is Tuesday!
  - Dirty filters work better!

Back-Wash Accident

http://www.katu.com/news/local/Nine-kids-end-up-in-the-hospital-after-toxic-incident-at-Tigard-gym-161691075.html

Chlorine ‘Gas-Bubble’

ClubSport Oregon, Tigard, July 2012.

- Accident happened late Sunday evening.
  - 10 children were hospitalized
    - Exposed at the shallow end of the pool.
- Accident caused by a ‘long-backwash’.
  - Water level fell
  - Acid & Chlorine pumped into pipes (but not into pool).
  - After backwash, acid & chlorine gas is pumped to pool
    - Inlet near shallow end (children)

Recently we had a pool accidently release chlorine gas into the pool. Even though it was an outdoor pool, they ended up sending a number of children to the hospital for inhalation problems. I believe all recovered OK. Because of the number of victims, it required the response of four fire department engine companies; a very significant response.

The pool is much like most other pools in Oregon. The pump is interlocked with the disinfectant and acid feeders to all shut off at the same time. Unfortunately, when a pool is backwashing their filter, the pump is running, so the disinfectant feeders can also run. Some pools know enough to turn off the disinfectant feeders when they backwash, but I think you will find them in the minority.

In this case, it appears that they may have begun backwashing and walked away for a while. The pump backwashed enough water out of the pool to lose prime (water below the skimmers), and the chemical feeders continued to pump. When they finally got back to finish the backwash, there was substantial chlorine and acid accumulated in the piping going back to the pool. The acid caused the chlorine compound to break down into Cl gas. This was released into the pool in the shallow end where a number of children were playing.

Lessons learned:

1. Pay attention to what you are doing. A normal backwash is usually 3 - 5 minutes long. This is not enough time to accumulate any significant amounts of chlorine and acid in the piping. Better yet! The operator should know to turn off the chemical feeders while they are backwashing. In this case they walked away for a while and the feeders continued to pump. Don't get distracted.

2. Don't backwash when there are people in the pool. It was doubly dangerous because the pump lowered the water level significantly before it lost prime. This means that there is increased danger to people jumping or diving into the pool. It can also sometimes make it much harder to exit the pool.

3. Running a pump without moving water through it will cause the pump to overheat and burn out or damage the seals.

4. There are now easy to install flow switches that can be put on the return lines to shut off the chemical feeders when there is no water flow. A number of electronic chemical controllers are set up to work with a flow switch, but a controller is not needed to install a flow switch. Because these switches cost money, they are often not installed. In discussions with the responding pool service company I found out that there are a variety of switches available. We discussed the possibility of adding something to the pool rules.

Electronic chemical controllers do have an overfeed control that turns the feed equipment off if it runs for too long a period. These were added because there were a number of accidents involving feeder pumps that continued running because there was no flow past the sampling electrodes. If there was not enough chemical in the water at the sensor when the flow stopped, it caused the system to continue to pump in chemicals
---
I am letting you know, because this situation was easily avoidable. It was not an equipment failure (which has also happened), but probably a poor decision on the part of the maintenance people. This happened with a chlorine product and acid, but something similar could happen with chlorine gas, CO_2 and possibly with salt water chlorine generators (either in-line or off-line). It is much more likely to have been even more serious if it had happened at an indoor pool.

Incidentally, as I understand it, the health department responded to the situation over the weekend and seemed to cover everything they needed to. They investigated and understood what happened, as much as anyone did, they required submittal of the accident reports, and they were doing follow-up with those involved. Good job!

Steve

Stephen Keifer
Public Swimming Pool Specialist
Oregon Health Authority
800 NE Oregon Street, Suite 640
Portland, OR 97232-2162
(971) 673-0448 Fax (971)673-0457
www.healthoregon.org/pl

Tagelus Top Mount—Sand Filter

Model Number	Filter Area Sq. Ft.	Vertical* Clearance	Filter Diameter	Required Sand† (lbs.)	Flow Rate GPM Res.**	Turnover Capacity (Gallons) 6hrs.	8hrs.	12hrs.
TA 40D	1.8	47"	18.75"	175	40	14,400	19,200	28,800
TA 50D	2.3	51.5"	21.25"	225	50	18,000	24,000	36,000
TA 60D	3.1	57"	24"	325	60	21,600	28,800	43,200
TA 100D	4.9	65.5"	30"	600	100	36,000	48,000	72,000

*Required clearance to remove the valve
**Maximum flow rate
†Use standard #20 silica sand

Performance Data – Filter

Model Number	Effective Filtration Area	Design Flow Rate	Turnover (In Gallons) 8 Hours	10 Hours
S144T	1.07 ft.²	25 GPM	12,000	15,000
S166T	1.40 ft.²	30 GPM	14,400	18,000
S180T	1.75 ft.²	35 GPM	16,800	21,000
S210T	2.20 ft.²	44 GPM	21,120	26,400

Performance Data – Valve Positions

Model Number	Filter	Back-wash	Waste	Recirc-ulate	Rinse	Closed	Winter
SP0714T	•	•	•	•	•	•	•

Filter Performance Data:

- **What do you need to know?**
- **Pit falls?**

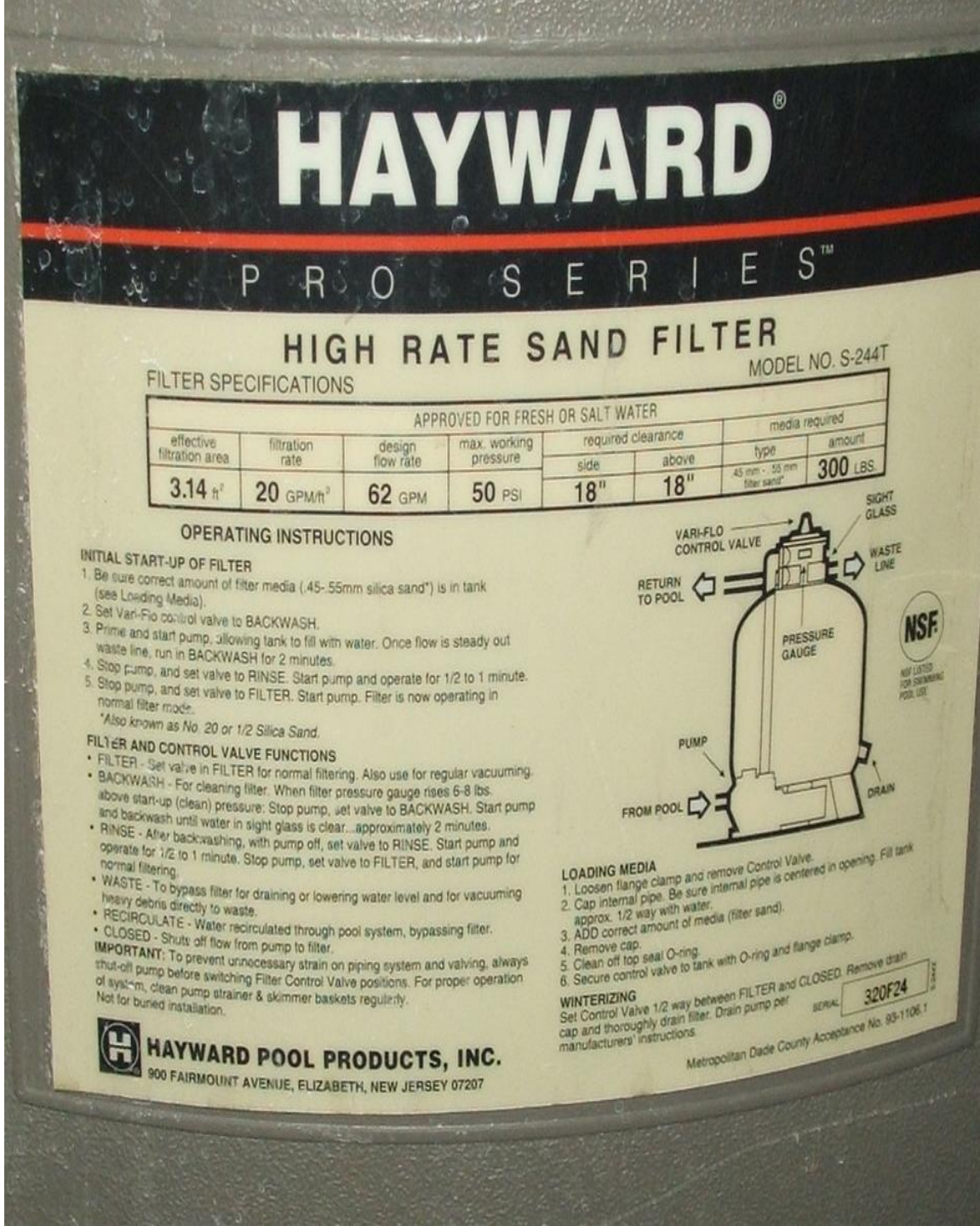
Know the minimum and maximum flow rates for your equipment and;

Understand specific tolerances for your equipment!

GPM – Min & Max

PSI – Min & Max

Write this stuff on the wall!



Diatomaceous Earth (DE) Filters

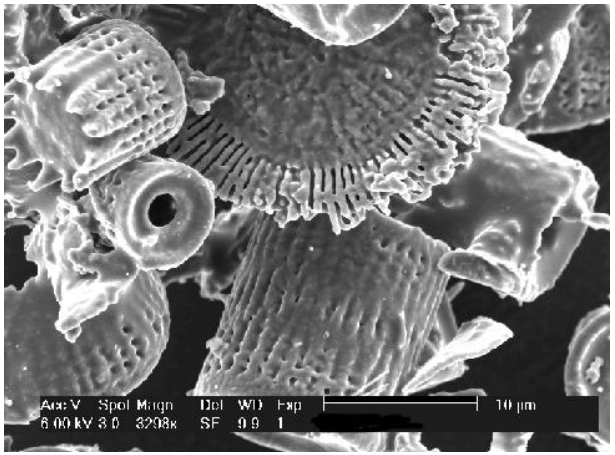
How a Diatomaceous Earth Pool Filter Works

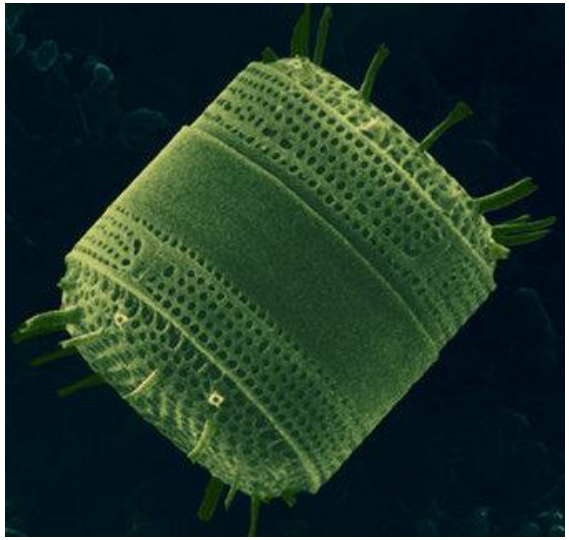
1. Manual Air Relief purges any trapped air during filter operation. Screenless design eliminates clogging.
2. Uniform Low Profile Tank Base make removal of grid nest fast and simple.
3. High-Strength Filter Tank molded of reinforced thermoplastic provides extra durability for dependable, corrosion-free performance.
4. High Impact Grid Elements designed for up-flow filtration and top-down backwashing for maximum efficiency.
5. Heavy-Duty Tamper-Proof Bolted Center Flange Clamp securely fastens tank top and bottom together. Allows quick access to all internal components without disturbing piping or connections.
6. Union Locknuts make disassemble and reassemble of filter from piping fast and easy.
7. Glass-filled polymer Bulkhead Fittings for extra strength and heat resistance.
8. Inlet- Diffuser Elbow distributes flow of incoming unfiltered water upward and evenly to all filter elements. Parabolic tank design provides for even distribution of D.E. to grids.
9. Full-Size 1.5" Integral Drain provides fast, 100% clean out and easier flushing of tank.
10. Convenient Valve and Plumbing Options allow for customized control. 2" internal piping and plumbing for maximum flow performance.

Filtering capability = 1 – 3 microns

Diatomaceous Earth (DE) Filters

- Diatoms are a major group of algae, and are one of the most common types of phytoplankton.
  - Wikipedia
- DE filtering capability = 1 – 3 microns





Cartridge Filters

Filtering capability = 5 – 10 microns

Cleaning a Cartridge Filter

- As the cartridge becomes clogged with dirt, it will need to be cleaned or replaced.
  - Usually an increase of 10 PSI above starting pressure.
- Perhaps 65% - 75% of filtering capacity is lost after each cleaning.
  - They need to be replaced often.
- Considering soaking the filter in trisodium phosphate (TSP).
  - Remember to rinse it!
- Muriatic acid may help remove oils
- Be gentle with paper filter material; it will tear easily.
  - Don’t use a high pressure sprayer; regular garden hose pressure should be adequate.

Any Questions?

First Thing in the Morning…

Determine that your pool is safe to open.

First Thing in the Morning…

Daily Pool Walk-Thru:

- Examine enclosure
- Look at the water.
- Smell the air
- Ensure safety equipment and personnel are in place.
- Examine the decks & other facilities for damage.
- Inspect skimmers
- Test water chemistry
- Check pump/equipment room

Enclosure

- Requirements:
  - At least 4 feet tall
  - No more than 4 inches of space (top, bottom, between bars)
  - Vertical rails required
  - At least 42 inches between horizontal bars.

Gates / Doors = Child Proof

- Self-closing & lock/latching

- Once closed, it must:
  - Remain locked or latched
    - Mechanism at least 42” above ground

Enclosure

- **What is wrong with these fences?**

First Thing in the Morning…

Enclosure

Water Clarity

- Cloudy (milky) water
- Algae
- Discolored water & staining
- Corrosion
- Sand in pool
- Water temperature

Air Quality

- Chlorine Odor
- Eye & skin irritation
- Corrosion
- Ventilation

Safety Equipment

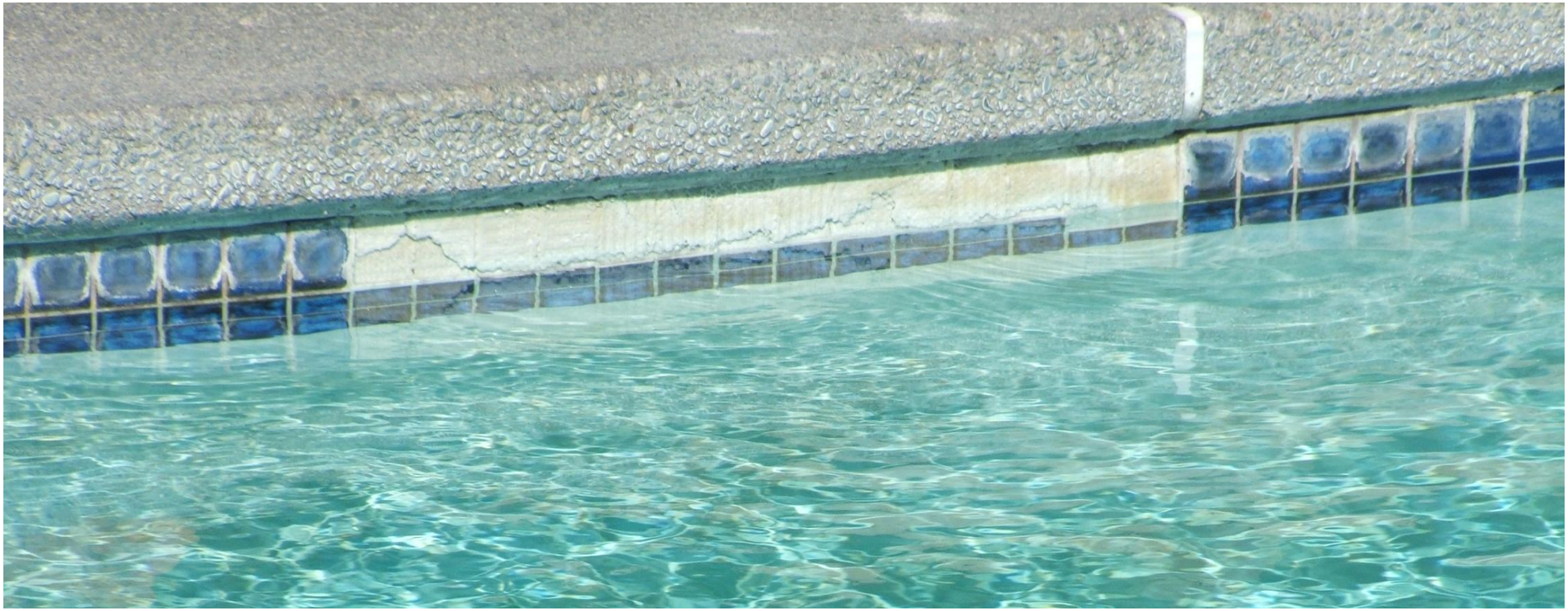
- Reach pole & hook
- Life buoy & rope
- Signs
- Deck markings
- Life line
- Ladder/stairs
- Lifeguard

Inspect Skimmers

- Clean out filter basket
- Look for strong flow through the drain
- Ensure skimmer gate is still in place and functional

Condition of the Facility

- Is the pool/spa in good condition?



First Thing in the Morning…

Test Water Quality Chemistry

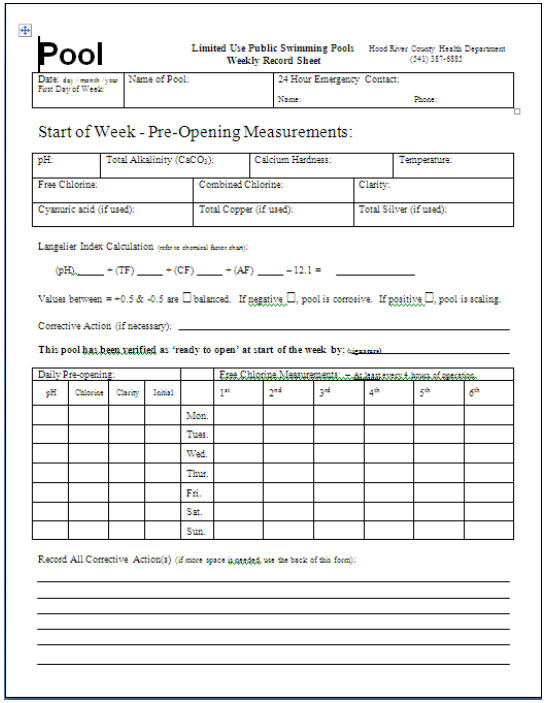
- **Start of the week:**
  - Measure and record **all** water quality parameters.
  - Calculate water balance
    - Langelier Index; or
    - Taylor® WaterGram

- **Every Day:**
  - Disinfectant Residual
  - pH
  - Alkalinity
  - Clarity
  - Temperature

First Thing in the Morning…

Pump Room

- Record water quality tests
- Record chemical dosages
- Verify that equipment is functioning
- Inspect automatic disinfectant feeder
- Check water pressure before and after filter
- Look for hazards



Pool

Limited Use Public Swimming Pools
Weekly Record Sheet

Hood River County Health Department
(541) 387-6885

Date: day / month / year First Day of Week:	Name of Pool:	24 Hour Emergency Contact: Name: Phone:

Start of Week - Pre-Opening Measurements:

pH:	Total Alkalinity ($CaCO_3$):	Calcium Hardness:	Temperature:
Free Chlorine:	Combined Chlorine:	Clarity:	
Cyanuric acid (if used):	Total Copper (if used):	Total Silver (if used):	

Langelier Index Calculation (refer to chemical factor chart):

(pH)_____ + (TF) _____ + (CF) _____ + (AF) _____ – 12.1 = _____

Values between = +0.5 & -0.5 are ☐ balanced. If negative ☐, pool is corrosive. If positive ☐, pool is scaling.

Corrective Action (if necessary): _____

This pool has been verified as 'ready to open' at start of the week by: (signature) _____

Daily Pre-opening					Free Chlorine Measurements – At least every 4 hours of operation.					
pH	Chlorine	Clarity	Initial		1st	2nd	3rd	4th	5th	6th
				Mon.						
				Tues.						
				Wed.						
				Thur.						
				Fri.						
				Sat.						
				Sun.						

Record All Corrective Action(s) (if more space is needed, use the back of this form):

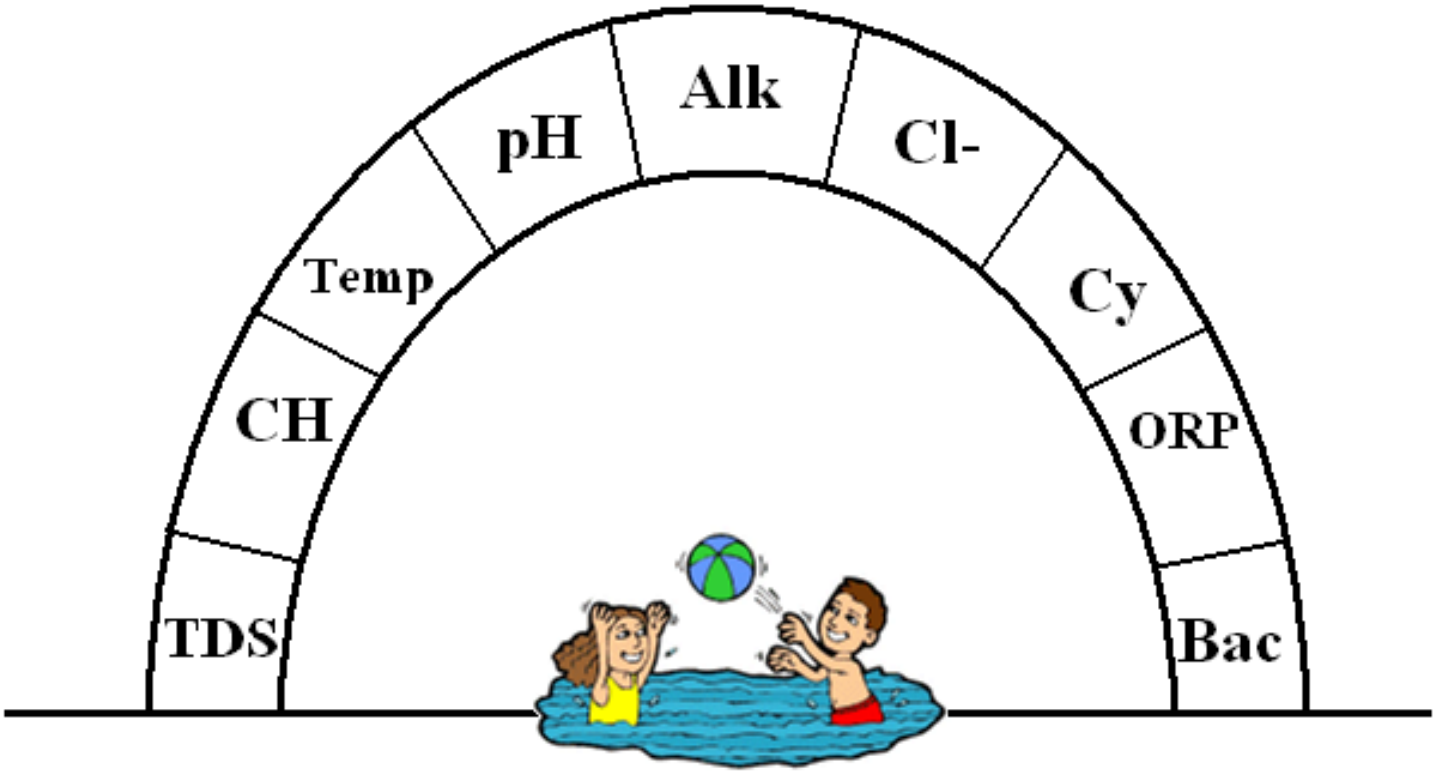
_____
_____
_____
_____
_____
_____

Any Questions?

Water Quality Parameters

Please read the label…

Water quality parameters are built on one another!



Water Quality Parameters

The Code:

Pool

Water Quality Parameters

TABLE 3

(333-60-200)

	Parameters	Min.	Ideal	Max.
(a)	free chlorine	0.8 ppm	1.0 - 3.0 ppm	5.0 ppm
(b)	combined chlorine	0	0	0.5 ppm
(c)	bromine	3.0 ppm	3.0 - 5.0 ppm	8.0 ppm
(d)	total copper	0	0	1.0 ppm
(e)	total silver	0	0	0.05 ppm
(f)	pH	7.2	7.4 - 7.6	7.6
(g)	total alkalinity as CaCo3	80 ppm	100 - 125 ppm	200 ppm
(h)	cyanuric acid	0 ppm	30 ppm	150 ppm
(i)	calcium hardness (recommended)	175 ppm		
(j)	turbidity (water clarity)	0/F.T.U.	0-0.5/F.T.U.	1.0/F.T.U.

(Or such clarity that a standard 2" (5cm) diameter clarity disc which is divided into alternate black and red quadrants is clearly visible and the separate colors discernible through 15 feet (4.57m) of water. Note: F.T.U. = Formalin Turbidity Unit.)

(k) bacteria Coliform organisms shall not be present in more than 15 percent of any series of samples and pseudomonas aeruginosa or other human pathogen shall not be present in any samples tested using Standard Methods for Testing Water and Waste Water 16th Edition. (Note: it is not required that this parameter be checked routinely but shall be monitored at the discretion of the Health Division.)

Spa

Water Quality Parameters

TABLE 1

(333-62-165)

	Parameters	Min.	Ideal	Max.
(a)	free chlorine	1.5 ppm	3.0	5.0 ppm
(b)	combined chlorine	0	0	0.5 ppm
(c)	bromine	3.0 ppm	3.0-5.0 ppm	8.0 ppm
(d)	Total copper	0	0	1.0 ppm
(e)	Total silver	0	0	0.05 ppm
(f)	pH	7.2	7.4 - 7.6	7.6
(g)	total alkalinity as CaCo3	80 ppm	Plaster & tile 175 ppm Spas 80-125 ppm	
	Vinyl, painted or fiberglass finishes		125 - 150 ppm	
(h)	cyanuric acid	0	30	150
(i)	calcium hardness (recommended)	100	200	
(j)	water temperature			104

(k) turbidity (water 0/F.T.U. 0-0.5/F.T.U. 1.0/F.T.U. or such clarity) that a standard 2" (5cm) diameter clarity disc which is divided into alternate black and red quadrants is clearly visible and the separate colors discernible through 15 feet (4.57m) of water. Note: F.T.U. = Formazin Turbidity Unit.

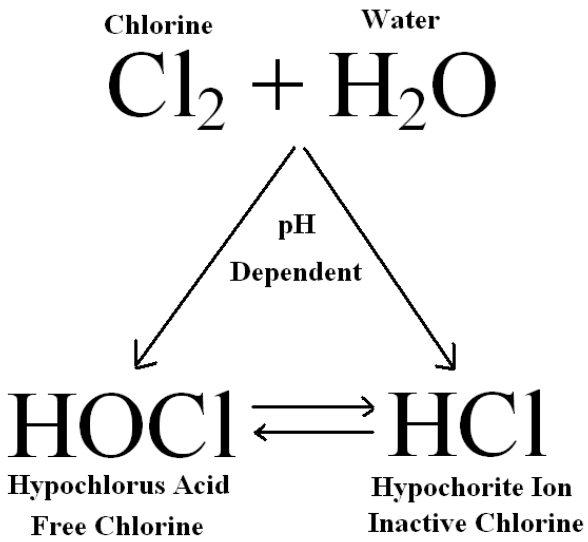
(l) bacteria (Coliform organisms shall not be present in more than 15 percent of any series of samples and pseudomonas aeruginosa or other human pathogen shall not be present in any samples tested using Standard Methods for Testing Water and Waste Water 16th Edition. (Note: it is not required that this parameter be checked routinely but shall be monitored at the discretion of the Health Division.)

Disinfection

1. **Disinfection** (sanitation) of bacteria, viruses algae, and other pathogens and oxidation of organic debris.

2. **Oxidation** is an important function that assists the filtering processes by burning up solid waste particles in the water. Many alternative sanitizers offer disinfection without oxidation, necessitating the purchase of additional chemicals.

3. **Residual Properties,** meaning that chlorine remains in the water for extended periods in order to be available to disinfect and oxidize as the need arises with increased swimmer loads.

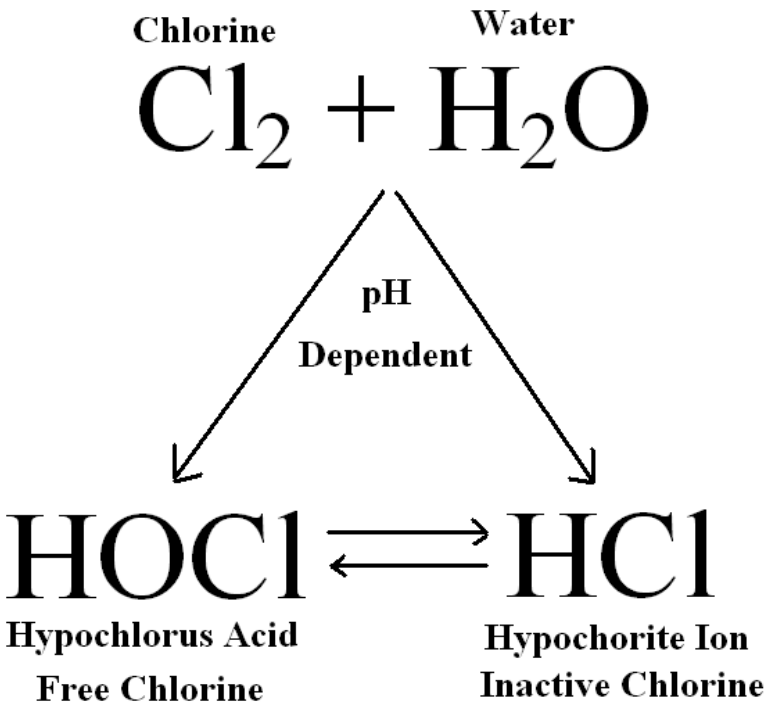


Forms of Chemical Disinfection

- Chlorine (HOCl)
- Bromine (HOBr)
- Less Common disinfectants:
  - Iodine
  - Ozone
  - Ultraviolet light
  - Hydrogen Peroxide
  - Polymeric Biguanide
  - Enzymes

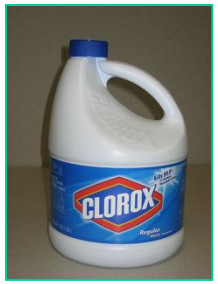
Also: Chlorine Generation

  - Saltwater systems

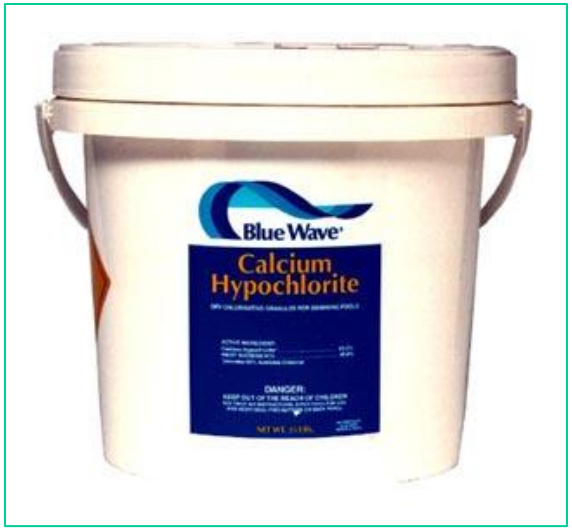


Forms of Chlorine

- Sodium Hypochlorite
  - $NaOCl + H_2O \rightarrow HOCl + Na^+$
  - 2 – 15 % available Chlorine
    - Read label!
  - 11 – 13 pH
    - (1% solution)



- Calcium Hypochlorite
  - $Ca(OCl)_2 + H_2O \rightarrow HOCl + Ca^{+2}$
  - 45 – 78 % available Chlorine
  - 8.5 – 11.8 pH
    - (1% solution)



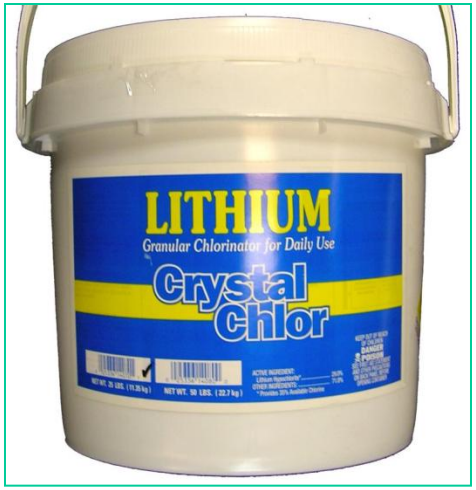
Concept: '*Available Chlorine*'

Volume of Water							
% Available Chlorine	400 Gallons	1,000 Gallons	5,000 Gallons	10,000 gallons	20,000 Gallons	50,000 Gallons	100,000 Gallons
10 %	0.51 fl oz	1.28 fl oz	6.40 fl oz	12.8 fl oz	1.60 pt	2.00 qt	1.00 gal
12 %	0.43 fl oz	1.07 fl oz	5.33 fl oz	10.7 fl oz	1.33 pt	1.67 qt	3.33 qt
35 %	0.15 oz	0.38 oz	1.91 oz	3.82 oz	7.63 oz	1.19 lb	2.38 lb
45 %	0.12 oz	0.30 oz	1.48 oz	2.97 oz	5.94 oz	14.8 oz	1.85 lb
60 %	0.09 oz	0.22 oz	1.11 oz	2.23 oz	4.45 oz	11.1 oz	1.39 lb
65 %	0.08 oz	0.21 oz	1.03 oz	2.05 oz	4.11 oz	10.3 oz	1.28 lb
75 %	0.07 oz	0.20 oz	0.95 oz	1.77 oz	3.77 oz	9.50 oz	1.17 lb
90 %	0.06 oz	0.15 oz	0.74 oz	1.48 oz	2.97 oz	7.42 oz	14.8 oz
100 %	0.05 oz	0.13 oz	0.67 oz	1.34 oz	2.67 oz	6.68 oz	13.4 oz

Forms of Chlorine

- Chlorine Gas
  - $Cl_2 + H_2O \rightarrow HOCl + HCl$
  - 100% available Chlorine
  - No effect on pH
    - (1% solution)

- Lithium Hypochlorite
  - $LiOCl + H_2O \rightarrow HOCl + Li^+$
  - 29 % available Chlorine
  - 10.8 pH
    - (1% solution)



Forms of 'Stabilized' Chlorine

- 'Trichlor'
  - *Trichloro-s-triazinetrione*
  - (Trichlor) + H_2O $\rightarrow$ HOCl + (Cyaniric Acid)
  - 90 % available Chlorine
  - 2.8 – 3.5 pH
    - (1% solution)

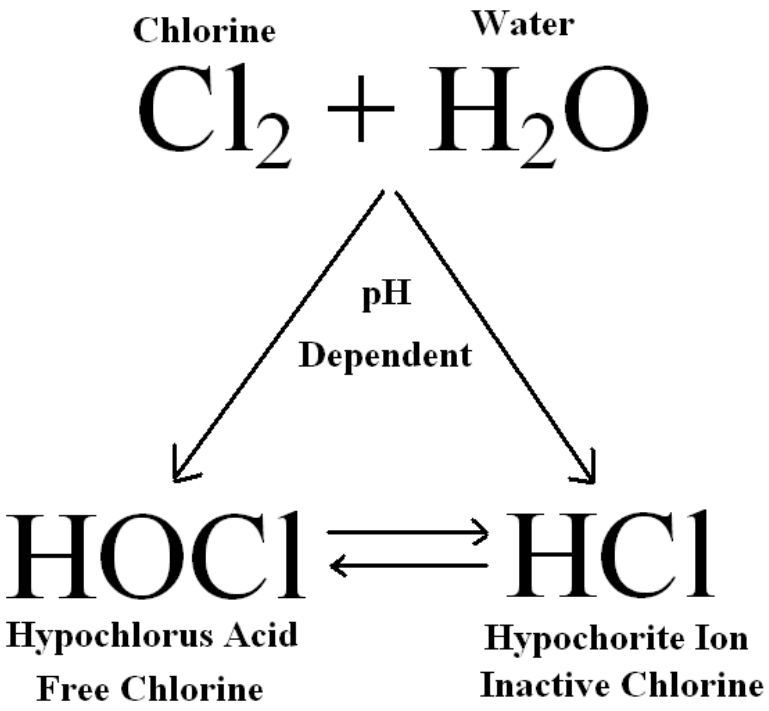
- 'Dichlor'
  - *Sodium Dichloro-s-triazinetrion*
  - (Dichlor) + H_2O $\rightarrow$ HOCl + (Cyaniric Acid)
  - Available Chlorine:
    - 62 – 63% (anhydrous)
    - 55 – 56% (dihydrate)
  - 6.7 pH
    - (1% solution)

Chlorine Generation

- Salt Water Pool
  - $2NaCl + 2H_2O + \text{electricity} \rightarrow 2NaOH + Cl_2 + H_2$
- Ocean Water
  - 35,000 ppm salt solution
- Human Body
  - 3,500 ppm salt solution
- Salt Water Pool
  - 2500 – 6000 ppm salt solution
  - 7.6 – 7.8 pH
    - (1% solution)

Free Chlorine (FC)

- Range:
  - 0.8 – 5.0 ppm (pool)
  - 1.5 – 5.0 ppm (spa)
  - Ideal 3.0 – 5.0 ppm
- Contact Time × Concentration = CT
- Forms (pH dependent):
  - HOCl – Good Chlorine
  - HCl – Weak Chlorine
- To:
  - Increase: adjust feeder / add chlorine
  - Decrease: add sodium thiosulfate



Free Chlorine (FC)

- **Pool:**
  - If the free chlorine level falls below **0.8ppm**:
    - Automatic closure of the pool
- **Spa:**
  - If the free chlorine level falls below **1.5ppm**:
    - Automatic closure of the spa

Pools:

Operation and Maintenance 333-060-0205

(1) Operators of public swimming pools shall be thoroughly knowledgeable on good practices of pool operation and with the laws and rules pertaining to public pools. If, at any time, testing indicates that the pool water does not conform with the requirements for clarity, ***minimum residual free chlorine or bromine****, or the pH exceeds 7.8 the pool operator shall immediately* ***close the pool*** *to the public until the requirements are satisfied.*

Spas:

Operation and Maintenance 333-62-170

(1) Operators of public spa pools shall be thoroughly knowledgeable on good practices of the spa operation and with the laws and rules pertaining to public spa pools. If, at any time, testing indicates that the spa water does not conform with the requirements for clarity, ***minimum residual free chlorine or bromine****, maximum temperature, or the pH exceeds 7.8 or falls below 7.0 the spa operator shall immediately* ***close the spa*** *to the public until the requirements are satisfied.*

Some Forms of Bromine

- BCDMH (1-bromo-3-chloro-5,5-dimethylhydantoin)
  - (BCDMH) + H_2O $\rightarrow$ HOBr + HOCl
  - 4.5 – 4.8 pH
    - In a 0.1% Solution
  - 58% available Bromine

- DBDMH (1,3-dibromo-5,5-dimethlyhydantoin)
  - (DBDMH) + H_2O $\rightarrow$ HOBr + (DMH)
  - 6.6 pH
    - In an aqueous slurry
  - 54% available Bromine

Total Bromine

- Range:
  - 3.0 – 8.0 ppm
  - Ideal 3.0 – 5.0 ppm
- Forms (pH dependent):
  - HOBr – Hypobromous acid
- To:
  - Increase: adjust feeder / add bromine
  - Decrease: Wait for time to pass
- Test:
  - Use the DPD kit
    - (convert measured amount by multiplying by ‘2.3’)

Disinfection-By-Products

- **Combined Chlorine**
  - Free Chlorine + Nitrogen, etc.
    - Eye & Skin irritation
    - Toxic
    - Poor air quality
      - Cause an acute injury
      - May cause asthma
  - **Max: 0.5 ppm**
- **Combined Bromine**
  - Free Bromine + Nitrogen, etc.
    - Degrades Quickly
    - Mutagenic
      - Bromoform
      - Bromodichloromethane
  - Not Regulated

pH

- **7.2 – 7.6 allowed**

"**P**otential of **H**ydrogen"

A measure of the acidity, alkalinity, or neutrality of water.

0.0 – 14.0 scale (logarithmic)

Low = acid

High = basic

7.0 = neutral

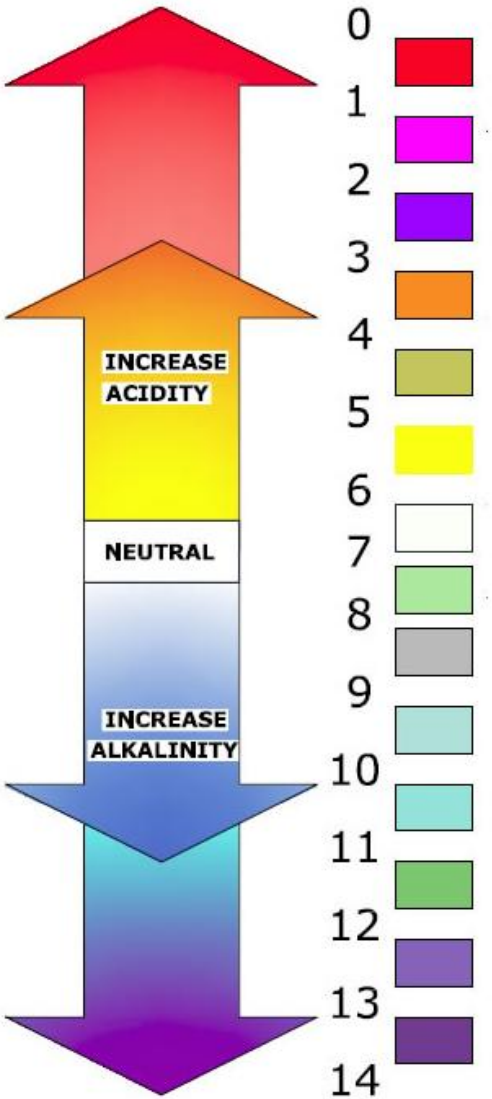
Adjustment:

Raise: add Soda Ash

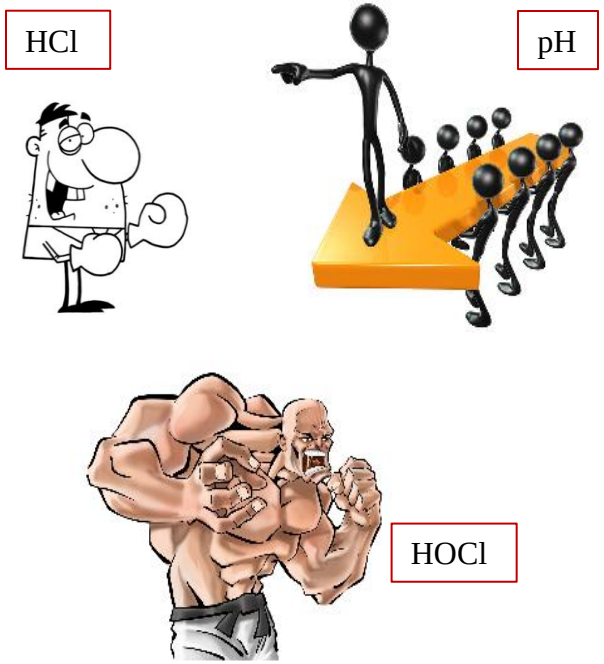
Sodium carbonate

Lower: add Muriatic Acid

HCl



pH



Chlorine Water

$$Cl_2 + H_2O$$

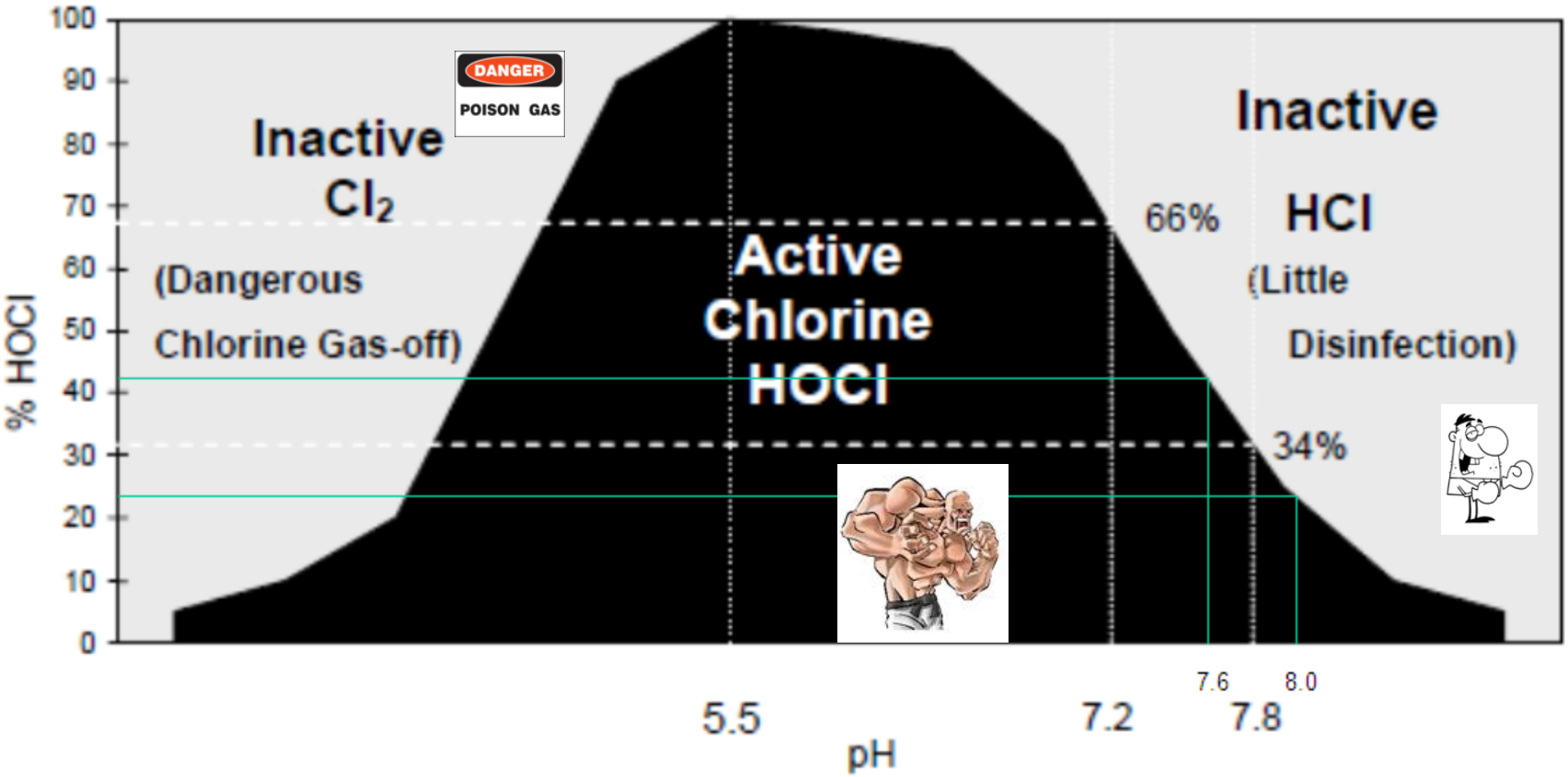
pH Dependent

$$HOCl \rightleftharpoons HCl$$

Hypochlorus Acid
Free Chlorine

Hypochorite Ion
Inactive Chlorine

pH affects Chlorine



% of HOCl Formed at Various pH Values

Combined Chlorine (Chloramines)

Toxic Public Pool Sends Kids to Hospital. Parents Want Answers

By Piper Weiss, Shine Staff | Parenting – Fri, Jun 22, 2012 5:23 PM EDT

Recommend 3.6k Tweet 113

Children were treated thursday after a mysterious incident at a public pool. (Michelle Pemberton/The Indianapolis ...

In Thursday's 90 degree heat-wave, Indianapolis' Garfield Park Pool seemed like the best place for locals to cool down. Then, in a moment, it became the worst.

"Mayhem," is how the Indianapolis Star's reporters described the scene as hoards of young swimmers began vomiting. Lifeguards rushed to evacuate the pool, as the reported odor of sharp chemicals flooded the area.

One mom on the scene described "an explosion of acid" rising from a once serene pool, though it's unclear what officially happened around 2 p.m. yesterday to sicken as many as 80 people, according to the Star's estimate.

Video: safety tips for summer swimming

"We haven't reached a final determination on the cause of yesterday's incident," John T. Althardt, spokesman for the Marion County Health Department, told Yahoo! Shine Friday. The pool employee on the scene that day might have more answers, but is still recovering in the hospital along with six other patients being treated for respiratory distress.

pH

- If pH climbs above 7.8, or below 7.0 (spa only):
  - Automatic closure of the pool or spa

Pool:

Operation and Maintenance 333-060-0205

(1) Operators of public swimming pools shall be thoroughly knowledgeable on good practices of pool operation and with the laws and rules pertaining to public pools. If, at any time, testing indicates that the pool water does not conform with the requirements for clarity, minimum residual free chlorine or bromine, or the ***pH exceeds 7.8*** *the pool operator shall immediately* ***close the pool*** *to the public until the requirements are satisfied.*

Spa:

Operation and Maintenance 333-62-170

(1) Operators of public spa pools shall be thoroughly knowledgeable on good practices of the spa operation and with the laws and rules pertaining to public spa pools. If, at any time, testing indicates that the spa water does not conform with the requirements for clarity, minimum residual free chlorine or bromine, maximum temperature, or the ***pH exceeds 7.8 or falls below 7.0*** *the spa operator shall immediately* ***close the spa*** *to the public until the requirements are satisfied.*

Total Alkalinity (TA)

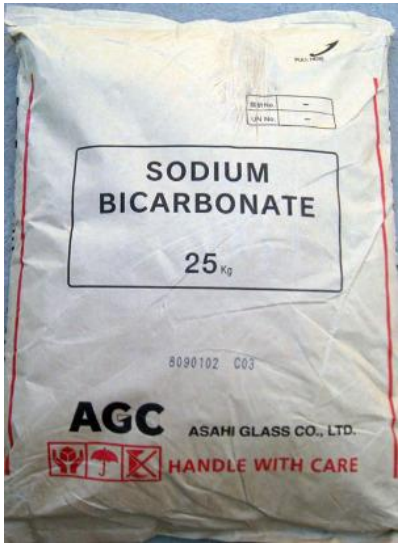
Sodium Bicarbonate

Measure of water's resistance to changes in pH

High TA: makes it harder to change pH & cloudy water

Low TA: causes pH to be unstable, corrosion, eye irritation, & green water

- To:
  - Increase: add Baking Soda
    - *Sodium Bicarbonate*
  - Decrease: add Muriatic Acid
    - HCl



Total Alkalinity (TA)

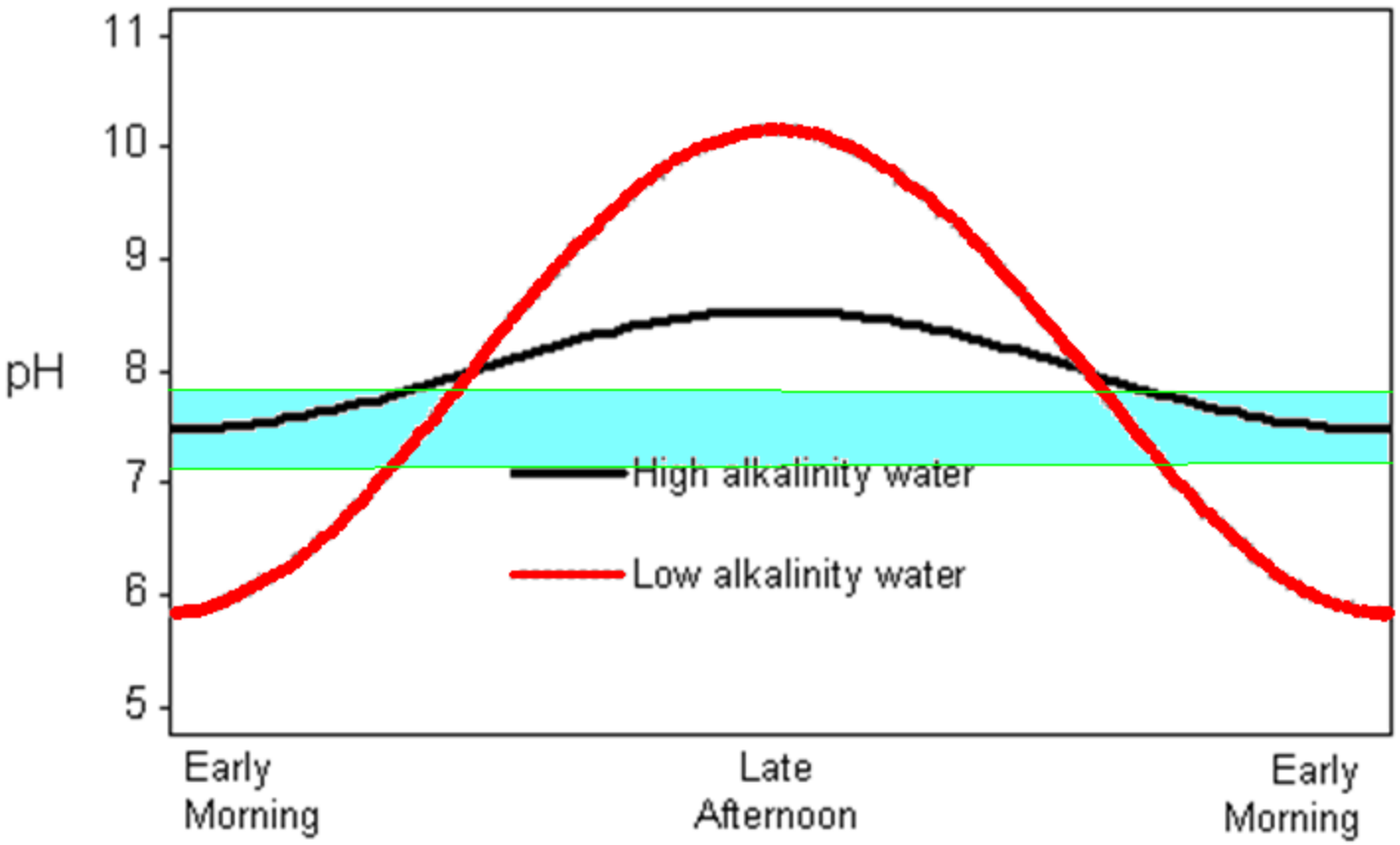


Fig. 1. Changes in pH during a 24-hour period in waters of high and low total alkalinities (Wurts and Durborow, 1992).

Calcium Hardness (CH)

- Mineral content of water
- **Hood River County has low Calcium Hardness**
- Low CH causes corrosive water
  - Damage to pool
- **Ideal Range:** 200 – 400ppm
- To:
  - Increase add Calcium Chloride
  - Decrease - Dilution

Temperature

- **Max: 104ºF**
- As temperature increases, calcium precipitates out of the water
- Important to balance water
- Swimmer comfort
- Health Risks

Operation and Maintenance 333-62-170

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Clarity

- Cloudy (Turbid)
- Clear (Sparkling)
- If you cannot see the bottom, close the pool!

Pool:

Operation and Maintenance 333-060-0205

(1) Operators of public swimming pools shall be thoroughly knowledgeable on good practices of pool operation and with the laws and rules pertaining to public pools. If, at any time, testing indicates that the pool water does not conform with the requirements for ***clarity****, minimum residual free chlorine or bromine, or the pH exceeds 7.8 the pool operator shall immediately* ***close the pool*** *to the public until the requirements are satisfied.*

Spa:

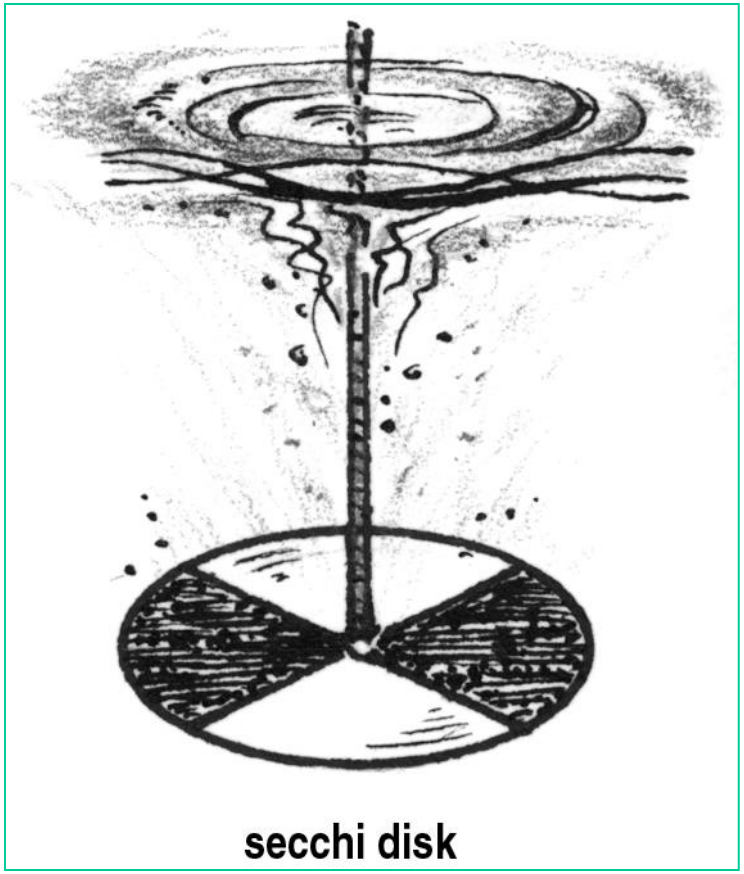
Operation and Maintenance 333-62-170

(1) Operators of public spa pools shall be thoroughly knowledgeable on good practices of the spa operation and with the laws and rules pertaining to public spa pools. If, at any time, testing indicates that the spa water does not conform with the requirements for ***clarity****, minimum residual free chlorine or bromine, maximum temperature, or the pH exceeds 7.8 or falls below 7.0 the spa operator shall immediately* ***close the spa*** *to the public until the requirements are satisfied.*

How Do We Measure Clarity?

Parameters	Min.	Ideal	Max.
turbidity (water clarity)	0/F.T.U.	0-0.5/F.T.U.	1.0/F.T.U.

- A standard 2" (5cm) diameter clarity disc which is divided into alternate black and red quadrants is clearly visible and the separate colors discernible through 15 feet (4.57m) of water. Note: F.T.U. = Formalin Turbidity Unit.

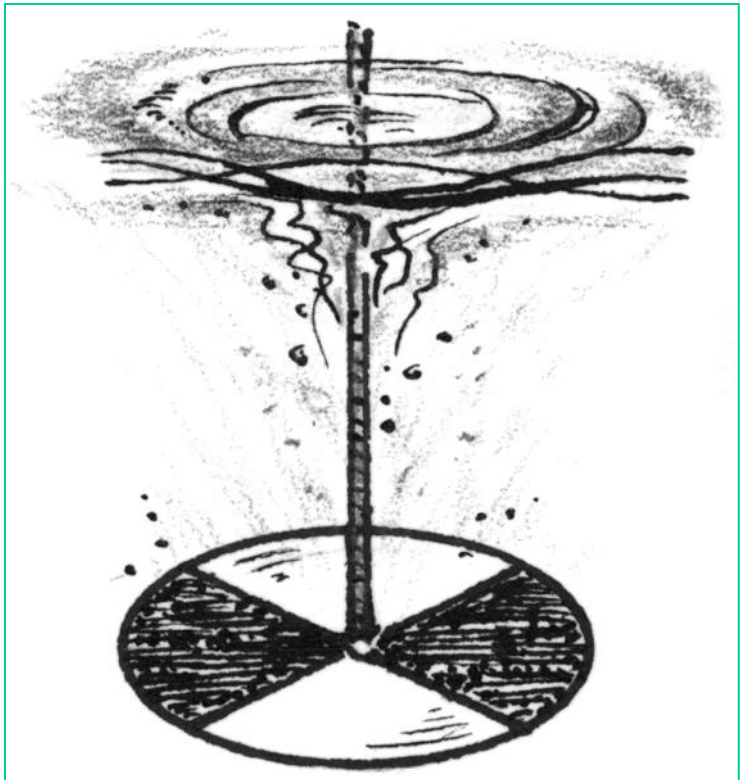


- ➢ Most pools & spas are not 15 feet deep!
- ➢ How do we convert?

How Do We Measure Clarity?

- How about a 5 point scale:
  1. Glistening
  2. Clear
  3. Transparent
  4. Dull-Cloudy
  5. Turbid-Cloudy

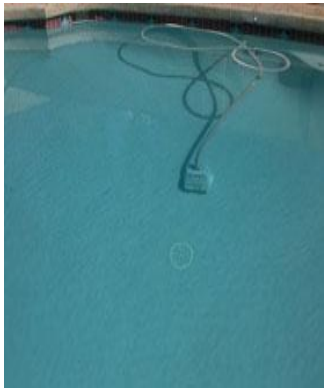
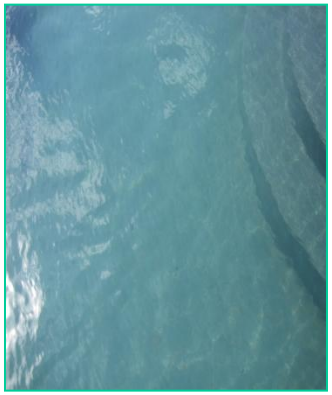
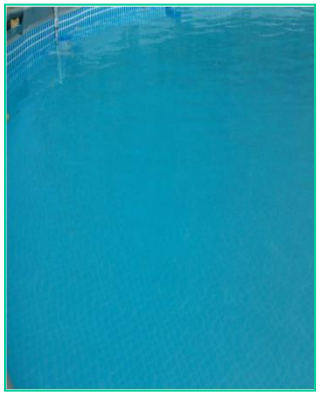
5 = Immediate Closure



secchi disk

Translation…

1	2	3	4	5
Glistening	Clear	Transparent	Dull-Cloudy	Turbid-Cloudy

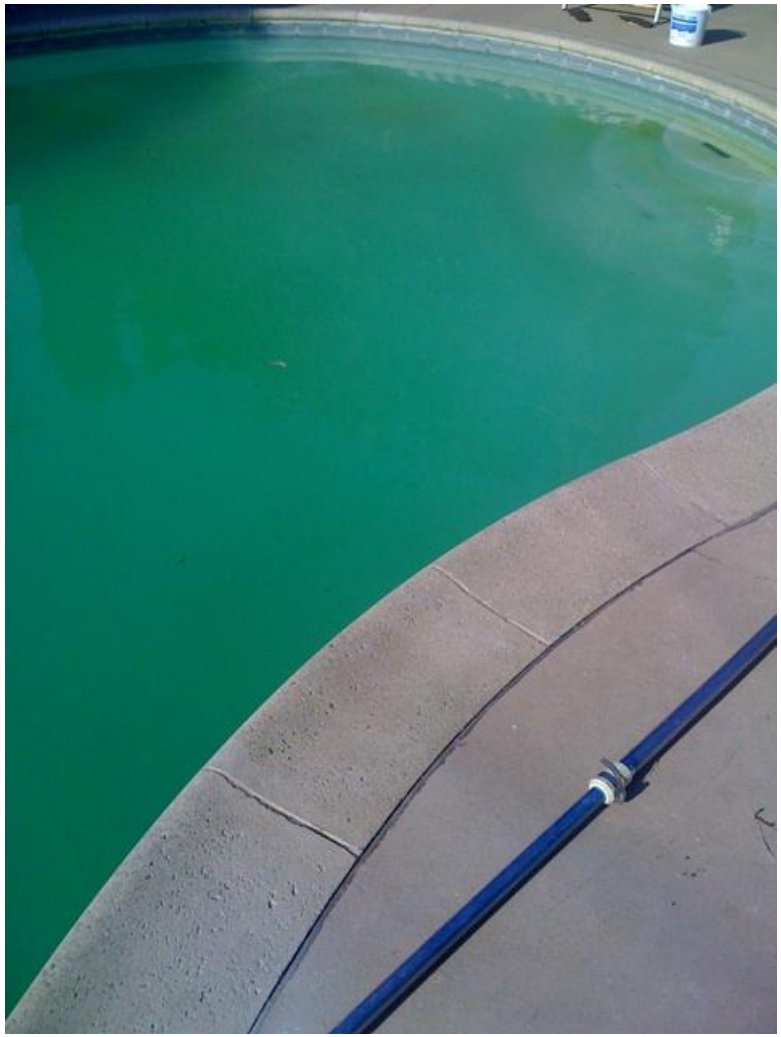




Open ⟷ Closed

Pictures are taken from random web-sites using Google® Image Search

Clarity

- Causes of poor water clarity:
  - Lack of disinfection leading to poor oxidation in the water.
  - High pH
  - Filter Problems
    - Check the flow meter
    - Calcification of the sand media (poor water balance)
  - Air in the water supply



Tragedy in Massachusetts

July 2011

- A woman's body remained unnoticed at the bottom of a public swimming pool for more than two days as people continued to swim in the water above.
- Lifeguards, health inspectors and other swimmers failed to notice the body of Marie Joseph, 36, because the water was cloudy.
- The 12 staff at the pool, including six lifeguards, were immediately placed on administrative leave, and the state of Massachusetts temporarily closed all 24 of its public deep water pools.
  - Several life guards & junior supervisors lost their jobs
- The inspector lost his job too
- Senior management officials are beginning to be held responsible, however, to-date they remain employed.
  - Testimony suggests that they were instrumental in pushing staff to keep the pool open.

Wednesday 16 November 2011

The Telegraph

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Woman's body 'lay undiscovered in public swimming pool for two days'

A woman's body is believed to have remained unnoticed at the bottom of a public swimming pool for more than two days as people continued to swim in the water above.

Share:

Recommend 284

Tweet 24

Share 0

+1 0

USA

News » World News » North America » Nick Allen »

IN USA

Marie Joseph, holding family friend Dalianys Melendez, daughter of Candella Matta, in the public swimming pool at Lafayette Park in Fall River, Mass

By Nick Allen, Los Angeles

5:29PM BST 01 Jul 2011

http://www.telegraph.co.uk/news/worldnews/northamerica/usa/8611462/Womans-body-lay-undiscovered-in-public-swimming-pool-for-two-days.html

Clarity

Actual Picture taken while woman had been in the pool for 12 hours (dead).

Clarity

The victim and the pool – Is this too cloudy?
What is the right course of action?

Clarity

Just to compare, this is a random air-photo of a swimming pool
How does the clarity compare?

Update

- **The inspector got his job back (with back pay).**
  - *He did not have the authority to close the pool.*
- **The pool staff, management and much of the recreation district experienced major restructuring.**
  - *Including getting rid of the management responsible for the tragedy.*
- **The pool has been re-built**
  - *$200,000.00*
  - *Closed for a year*

OUR VIEW: DCR has learned its lessons from pool death

Photos Zoom

Recommend Be the first of your friends to recommend this.

Jack Foley|Herald News Purchase this photo

DCR Commisioner Ed Lambert talks about the report, with Chief Ranger Curt Rudge at right.

FREE Online Banking Bill Pay and Telephone Account Access
Notre Dame Community Federal

Related Stories

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GUEST OPINION: It's time for Tiverton to reap rewards of the FTR vote

"This incident needs to be used to make the agency better," Lambert said, stressing that he insisted the report be used as an opportunity for accountability and improvement for his agency.

"We laid the agency wide open when we did it," explained Curt Rudge, DCR's chief ranger, who headed the investigation. "Warts and all," Lambert added.

That's both important and encouraging. DCR's reaction to Joseph's death was anything but knee-jerk, and appropriately so, despite its maddeningly slow pace. Rather than rushing to a judgment that may have satisfied those thirsting for accountability and looking to lay blame, DCR methodically turned itself inside out, emerging with a new structure and departmental re-organization that supports the public safety measures imperative to running public pools.

The investigation determined that systemic failure contributed to Joseph's death and DCR has committed itself to systemic change as a result.

From a personal and public policy perspective, often the most we can hope for when misfortune of this magnitude occurs is that something good comes from it; that a lesson has been learned.

There's no doubt that DCR has learned its lesson and has devoted itself to teaching that lesson going forward.

http://www.heraldnews.com/fall-river-pool-drowning/x206662410/OUR-VIEW-DCR-has-learned-its-lessons-from-pool-death?zc_p=0

After year of preparation, Veterans Memorial Pool set to reopen

Photos Zoom

Jack Foley|Herald News Purchase this photo

DCR's Director of Aquatics John Dwinell talks about the changes made and testing protocols in place at the Vietnam Veterans' Memorial Pool Friday. The spot on which he stands is where the slide used to be, with the pool depth at that end now at 5 feet 6 inches, raised from its original 12 feet. In Dwinell's hand is a Secchi disk, used to check water clarity.

Recommend 13 people recommend this. Be the first of your friends.

On the Web

More coverage of the Lafayette Park Pool drowning

Photo Galleries

DCR officials discuss changes at Lafayette Park Pool

Marie Joseph died on June 26, 2011. She slipped under the water and drowned after going down the water slide. She remained hidden under 12 feet of water for two days before her body floated to the surface. The water was too cloudy for Joseph to be seen.

Since then the pool has been rebuilt so the deepest portion is 5 feet, 6 inches. New filters and pumps were installed to address water-clarity problems. Lifeguards are under orders to clear the pool every 90 minutes and use a Secchi disk — a small, black-and-white disk — to make sure they can clearly see the pool bottom. Lifeguards will also put on masks and fins at every break and swim a grid pattern across the pool bottom to make sure it is clear.

The water on Friday was sparkling and clear as Lambert oversaw testing with Dwinell and Raul Silva, the chief engineer for the DCR.

With the renovation, the DCR also built a wheelchair ramp that goes into the pool. The ramp will have a motorized chair to help disabled people get into and out of the pool.

The lifeguards will be busier. Besides watching swimmers from 10 a.m. to 6 p.m. each day, there are plans for beginner swim classes. Lifeguards will also have to get into the pool every day to practice lifesaving techniques. Every lifeguard will have to swim 200 yards in less than 3 minutes and 30 seconds every day, Dwinell said.

Cyanuric Acid

Protects Chlorine from UV Light

Ideal level is 5 to 30 ppm

Like air in your tires.

- *Too little is bad*
- *Too much is bad*

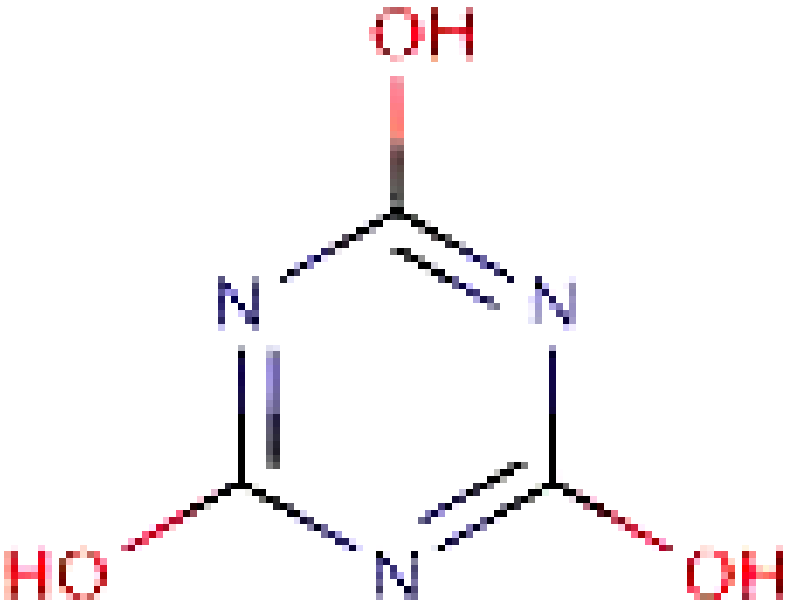
To much and chlorine cannot work (+50ppm)

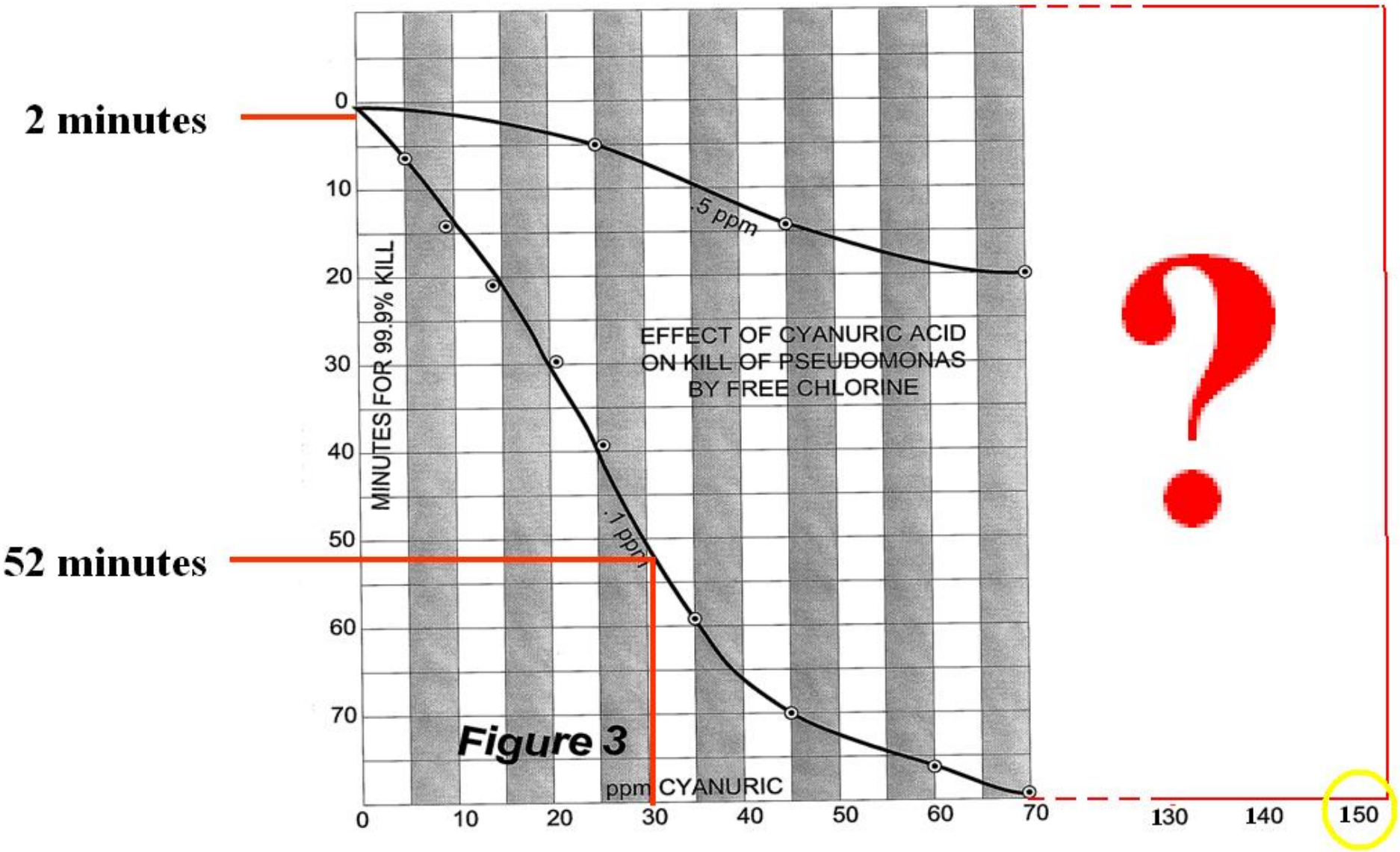
To little in outdoor pool and chlorine not protected

Dilute to remove

Cyanuric Acid stays behind after chlorine is used up

Dump vessel, replace with fresh water and brush plaster!




2 minutes
52 minutes
MINUTES FOR 99.9% KILL
0
10
20
30
40
50
60
70
.5 ppm
.1 ppm
EFFECT OF CYANURIC ACID
ON KILL OF PSEUDOMONAS
BY FREE CHLORINE
Figure 3
ppm CYANURIC
0
10
20
30
40
50
60
70
130
140
150
?

Total Alkalinity & Cyanuric Acid

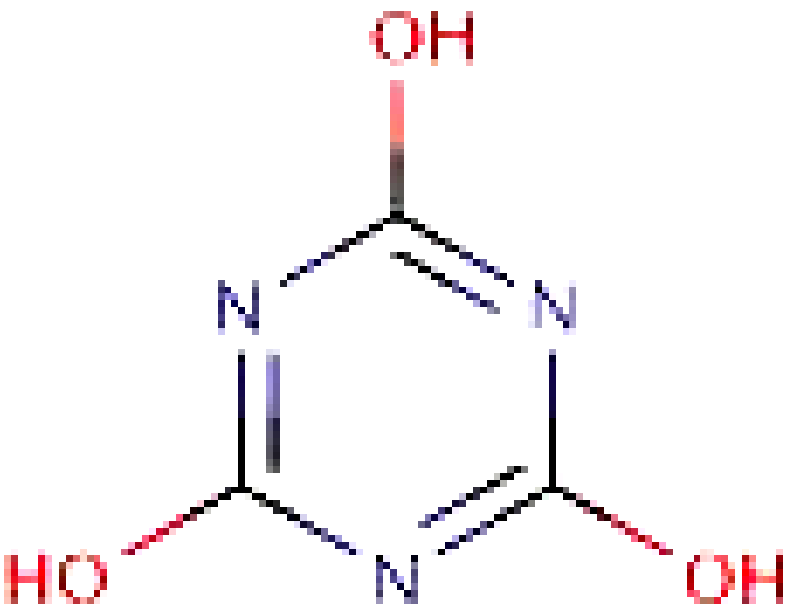
Disrupts Alkalinity Measurements

May represent 1/3 of your measured alkalinity value.

For example:

- Measured Cyanuric Acid = 150ppm
- Measured Alkalinity = 90ppm
- Real Alkalinity = 40ppm

Leads to pH bounce!



Total Alkalinity & Cyanuric Acid

Calculate the Alkalinity (Alk_C) from the measured total alkalinity (Alk_{TA}), measured Cyanuric Acid (CYA), and selected Cyanuric acid factor (CYAf)

$$Alk_C = Alk_{TA} - (CYA \times CYAf)$$

pH	CYAf
7.0	0.22
7.2	0.26
7.4	0.30
7.6	0.33
7.8	0.36

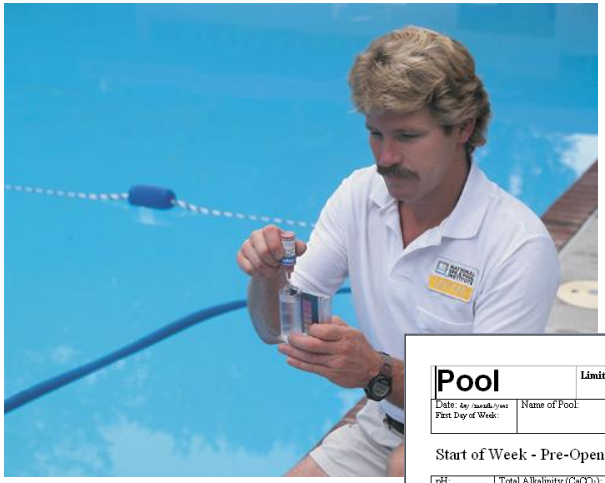
- For example:

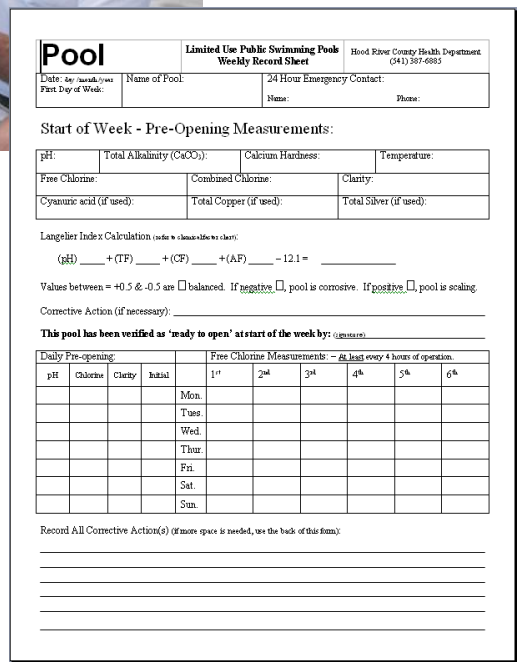
  pH = 7.6; Alk_{TA} = 100ppm; CYA = 40ppm

  - $Alk_C = Alk_{TA} - (CYA \times CYAf)$
  - $Alk_C = 100 - (40 \times 0.33)$
  - $Alk_C = 87$ ppm

Monitoring Water Quality

- State Code requires that pool/spa water quality be monitored regularly
- pH & Free Chlorine and the most frequent parameters measured
- Measurements must be recorded and retained





Pool | **Limited Use Public Swimming Pools Weekly Record Sheet** | Hood River County Health Department (541) 387-6885

Date: day/month/year
First Day of Week:
Name of Pool:
24 Hour Emergency Contact:
Name: Phone:

Start of Week - Pre-Opening Measurements:

pH:	Total Alkalinity ($CaCO_3$):	Calcium Hardness:	Temperature:
Free Chlorine:	Combined Chlorine:	Clarity:	
Cyanuric acid (if used):	Total Copper (if used):	Total Silver (if used):	

Langelier Index Calculation (refer to chemistrybot chart):

(pH) ____ + (TF) ____ + (CF) ____ + (AF) ____ – 12.1 = _____

Values between = +0.5 & -0.5 are balanced. If negative, pool is corrosive. If positive, pool is scaling.

Corrective Action (if necessary): _____

This pool has been verified as 'ready to open' at start of the week by: (signature) _____

Daily Pre-opening:					Free Chlorine Measurements: – At least every 4 hours of operation.					
pH	Chlorine	Clarity	Initial		1st	2nd	3rd	4th	5th	6th
				Mon.						
				Tues.						
				Wed.						
				Thur.						
				Fri.						
				Sat.						
				Sun.						

Record All Corrective Action(s) (If more space is needed, use the back of this form):

_____
_____
_____
_____
_____
_____

What is Required?

Spa Water Quality 333-62-165:

(3) Pool operators shall test and record the parameters described in section (1) of this rule with the following minimum frequencies during periods when the pool is open for use:

(a) pH -- every 2 hours;

(b) Chlorine (Non-stabilized) -- hourly; chlorine (stabilized) -- every 2 hours; continuous reading devices shall satisfy requirements of subsections (3)(a) and (b) of this rule if such devices record in pH units and ppm of free chlorine;

(c) Bromine -- hourly; continuous reading devices shall record in units of ppm bromine;

(d) Total alkalinity -- daily...

(g) Turbidity -- daily;

(h) Cyanuric acid -- weekly (when using stabilized chlorine);

(i) Calcium hardness -- weekly (recommended)

Pool Water Quality 333-060-0200:

(3) Pool operators shall test and record the parameters described in paragraph (2)(a) and (2)(b) of this section with the following minimum frequencies during periods when the pool is open for use:

(a) pH - daily

(b) Chlorine

(A) Outdoor Pools:

Chlorine (Non-stabilized) - hourly

Chlorine (Stabilized with a minimum of 30 ppm cyanuric acid) - every 4 hours

(B) Indoor Pools: - Chlorine - every 4 hours

(c) Bromine

(A) Outdoor Pools: - Bromine - hourly

(B) Indoor Pools: - Bromine - every 4 hours

(d) Continuous reading devices shall satisfy requirements (3)(a) and (b), and (c) if such devices record in pH units and ppm of free chlorine or bromine...

(g) Total alkalinity - weekly

(h) Calcium hardness - (recommended) - weekly

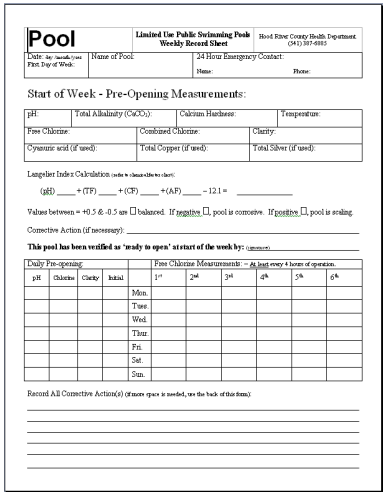
(i) Turbidity - daily

(j) Cyanuric acid (if used) - monthly.

Hood River County Health Department Recommends:

	Outdoor* Pool	Indoor† Pool	Outdoor* Spa	Indoor† Spa
Chlorine Ψ / Bromine	Hourly	Every 4 hours	Hourly	Every 2 hours
pH	Daily		Every 2 hours	
Alkalinity	Weekly		Daily	
Temperature	Weekly		Daily	
Calcium Hardness	Weekly			
Cyanuric Acid	Weekly			

Ψ Also check 'Combined-Chlorine' at this time
** Non-Stabilized Outdoor Pool/Spa with Chlorine Disinfection*
† May include outdoor Pool/Spa with Stabilized Chlorine (Cyanuric Acid) or Bromine



Pool — Limited Use Public Swimming Pools Weekly Record Sheet — Hood River County Health Department (541) 387-6885

Date: day/month/year; First Day of Week: | Name of Pool: | 24 Hour Emergency Contact: Name: Phone:

Start of Week - Pre-Opening Measurements:

pH:	Total Alkalinity ($CaCO_3$):	Calcium Hardness:	Temperature:
Free Chlorine:	Combined Chlorine:	Clarity:	
Cyanuric acid (if used):	Total Copper (if used):	Total Silver (if used):	

Langelier Index Calculation (refer to chemical factor chart):

(pH) ____ + (TF) ____ + (CF) ____ + (AF) ____ – 12.1 = _____

Values between = +0.5 & -0.5 are ☐ balanced. If negative ☐, pool is corrosive. If positive ☐, pool is scaling.

Corrective Action (if necessary): _____

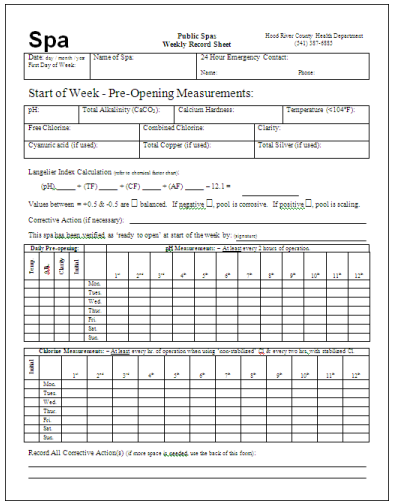
This pool has been verified as 'ready to open' at start of the week by: (signature) _____

Daily Pre-opening: | Free Chlorine Measurements – At least every 4 hours of operation.

pH	Chlorine	Clarity	Initial		1st	2nd	3rd	4th	5th	6th
				Mon.						
				Tues.						
				Wed.						
				Thur.						
				Fri.						
				Sat.						
				Sun.						

Record All Corrective Action(s) (if more space is needed, use the back of this form):

_____



Spa — Public Spas: Weekly Record Sheet — Hood River County Health Department (541) 387-6885

Date: day/month/year; First Day of Week: | Name of Spa: | 24 Hour Emergency Contact: Name: Phone:

Start of Week - Pre-Opening Measurements:

pH:	Total Alkalinity ($CaCO_3$):	Calcium Hardness:	Temperature (<104°F):
Free Chlorine:	Combined Chlorine:	Clarity:	
Cyanuric acid (if used):	Total Copper (if used):	Total Silver (if used):	

Langelier Index Calculation (refer to chemical factor chart):

(pH) ____ + (TF) ____ + (CF) ____ + (AF) ____ – 12.1 = _____

Values between = +0.5 & -0.5 are ☐ balanced. If negative ☐, pool is corrosive. If positive ☐, pool is scaling.

Corrective Action (if necessary): _____

This spa has been verified as 'ready to open' at start of the week by: (signature) _____

Daily Pre-opening: | pH Measurements – At least every 2 hours of operation.

Temp	Alk.	Clarity	Initial		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
				Mon.												
				Tues.												
				Wed.												
				Thur.												
				Fri.												
				Sat.												
				Sun.												

Chlorine Measurements – At least every hr. of operation if/ttes using non-stabilized ☐ or, if every two hrs. with stabilized ☐.

Initial	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Mon.												
Tues.												
Wed.												
Thur.												
Fri.												
Sat.												
Sun.												

Record All Corrective Action(s) (if more space is needed, use the back of this form):

_____

SPA SEPTEMBER '07

Daily CHLORINE Records

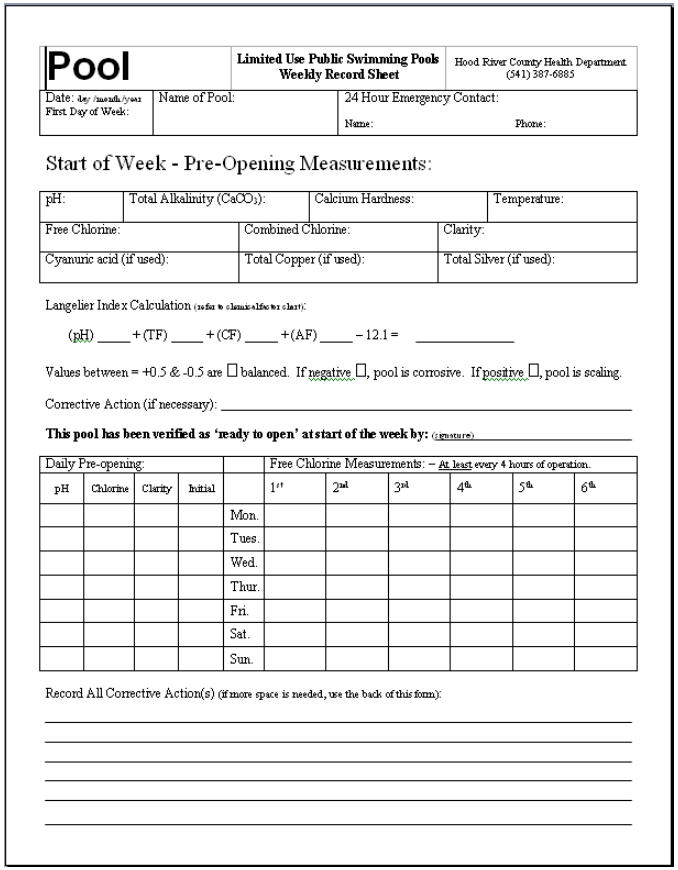
Free Clorine (DPD #1) ppm Min = 1.5 ppm
Free Clorine (DPD #3) ppm IDEAL = 3.0 ppm
TEST EVERY 2 HOURS Max = 5.0 ppm

Date:
DAILY PH RECORDS - Test every 2 Hours
Min = 7.2, Ideal = 7.4 - 7.6, Max = 7.6
Temperature Max = 104 F

DAY : Month	Time 7 am	9:00 AM	11:00 AM	1:00 PM	3:00 PM	5:00 PM	7:00 PM	9:00 PM	Alkalinity Daily Min=80 Max = 175	Acid Added	Soda Ash Added	Emptied Pool	Superchlorinated or Oxidized	Time 7 am	9:00 AM	11:00 AM	1:00 PM	3:00 PM	5:00 PM	7:00 PM	9:00 PM
1	1.5					1.5								7.4					7.4		
2	1.5					1.5								7.4					7.5		
3	1.5					1.5								7.2					7.2		
4	1.5					1.5							✓	7.4					7.2		
5	2					2								7.4					7.4		
6	1.5					1.5								7.4					7.4		
7	1.5					1.5				✓			✓	7.8					7.8		
8	1.5					1.5								7.4					7.4		
9	1.5					1.5								7.4					7.4		
10																					
11			5													7.1					
12																					
13																					
14	3													7.6							
15																					
16	3					3				✓				7.4					7.4		
17																					
18	3					3															
19	3																				
20																					
21																					
22						1.5								7.4							
23	1.5													7.4							
24		(DRAINED)								✓			✓			7.6					
25		5																			
26																					
27							3												7.4		
28																					
29																					
30	3						3						✓						7.6		
31																					

What Should Be In A Record?

- Show your work
  - *Both good and bad results!*
- Preserve data for the next operator / shift change.
- Dosages
- Think about liability!



Pool | **Limited Use Public Swimming Pools Weekly Record Sheet** | Hood River County Health Department (541) 387-6885

Date: day/month/year
First Day of Week:

Name of Pool:

24 Hour Emergency Contact:
Name: Phone:

Start of Week - Pre-Opening Measurements:

pH:	Total Alkalinity ($CaCO_3$):	Calcium Hardness:	Temperature:
Free Chlorine:	Combined Chlorine:	Clarity:	
Cyanuric acid (if used):	Total Copper (if used):	Total Silver (if used):	

Langelier Index Calculation (refer to chemical/factor chart):

(pH) ____ + (TF) ____ + (CF) ____ + (AF) ____ – 12.1 = _____

Values between = +0.5 & -0.5 are ☐ balanced. If negative ☐, pool is corrosive. If positive ☐, pool is scaling.

Corrective Action (if necessary): _____

This pool has been verified as 'ready to open' at start of the week by: (signature) _____

Daily Pre-opening:					Free Chlorine Measurements: – At least every 4 hours of operation.					
pH	Chlorine	Clarity	Initial		1st	2nd	3rd	4th	5th	6th
				Mon.						
				Tues.						
				Wed.						
				Thur.						
				Fri.						
				Sat.						
				Sun.						

Record All Corrective Action(s) (if more space is needed, use the back of this form):

Hood River County Web-Site: http://www.co.hood-river.or.us/

What Should Be In A Record?

Pool

Limited Use Public Swimming Pools
Weekly Record Sheet

Hood River County Health Department
(541) 387-6885

Date: day / month / year First Day of Week:	Name of Pool:	24 Hour Emergency Contact:
1/30/12	Splash Pool	Name: Ian Phone: 541-123-1234

Start of Week - Pre-Opening Measurements:

Free Chlorine:	Combined Chlorine	Potential of Hydrogen:	Carbonate Alkalinity:	Calcium Hardness:	Cyanuric Acid	Temperature:	F.T.U:
FC: 1.0	CC: 1.5	pH: 7.2	Alk: 80	CH: 300	Cy: 50	°F: 84	Clarity: clear.

Notes: Added K-monopersulfate, adjusted erosion feeder.

Water Balance Calculation (calculate langelier index or use the *Taylor® Watergram, Water Balance Calculator* in your test kit):
(pH) _____ + (TF) _____ + (CF) _____ + (AF) _____ – 12.1 = -2.5
Values between = +0.5 & -0.5 are balanced. If < -0.5, pool is corrosive. If > +0.5, pool is scaling.

Corrective Actions, Dosing, etc: 5oz of K-mono, feeder to #2

This pool has been verified as 'ready to open' at start of the week by: (signature)

Daily Pre-opening:						Free Chlorine Measurement Periods: – At least every 4 hours of operation[1].									
pH	FC	CC	Alk	Clarity		1st		2nd		3rd		4th		5th	6th
7.2	1.0	1.5	80	good	Mon.	2.0	N/D	2.5	ND	3.0	N/D	3.5	0.5	Closed	
7.4	5.5	0.5	100	good	Tues.	5.5	N/D	5.0	ND	5.0	ND	4.5	0.5	Closed.	
					Wed.										
					Thur.										
					Fri.										
					Sat.										
					Sun.										

Record all corrective action(s), dosing, etc. (if more space is needed, use the back of this form): 1/31/12 - added 2oz of K-monopersulfate. Adjusted erosion feeder to #1.5, added 1oz of Cl at close.

[1] Test hourly if you are operating an outdoor pool without a stabilizer (Cyanuric acid < 5ppm).

Spa

Public Spas
Weekly Record Sheet

Hood River County Health Department
(541) 387-6885

Date: day / month / year First Day of Week:	Name of Spa:	24 Hour Emergency Contact:
1/30/12	Splash + Soak.	Name: Ian Phone: 541-123-4567

Start of week pre-opening measurements performed at: _____.

Free Chlorine:	Combined Chlorine	Potential of Hydrogen:	Carbonate Alkalinity:	Calcium Hardness:	Cyanuric Acid	Temperature:	F.T.U:
FC: ND	CC: 1.5	pH: 7.0	Alk: 50ppm	CH: 400	Cy: 80	°F: 103	Clarity: Dull

Notes: Began by shocking the Spa, added Cl increase 16ppm. Increased Alk. Lowered pH. By 10am, everything in balance: 8ppm FC, ND/CC, Alk = 100, pH = 7.3, Crystal Clear.

Water Balance Calculation (calculate the langelier index or use the *Taylor® Watergram, Water Balance Calculator found* in your test kit):
(pH) _____ + (TF) _____ + (CF) _____ + (AF) _____ – 12.1 = 0.2
Values between = +0.5 & -0.5 are balanced. If < -0.5, pool is corrosive. If > +0.5, pool is scaling.

Corrective Actions, Dosing, etc: 2cups of Cl, ½ cup of Baking Soda, ½ cup of muriatic Acid.

This pool has been verified as 'ready to open' at start of the week by: (signature)

Daily Pre-opening:					pH Measurements: – At least every 2 hours of operation.											
pH	Alk	Clarity	Temp		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
7.3	100	✓	103	Mon.	7.3	7.4	7.6	7.2	7.2	7.2	closed.					
				Tues.												
				Wed.												
				Thur.												
				Fri.												
				Sat.												
				Sun.												

Chlorine Measurements: – At least every 2 hours of operation *(hourly if outdoor spa using non-stabilized chlorine)*

Daily Pre-opening: FC	CC		1st FC	1st CC	2nd FC	2nd CC	3rd FC	3rd CC	4th FC	4th CC	5th FC	5th CC	6th FC	6th CC	7th FC	7th CC	8th FC	8th CC	9th FC	9th CC	10th FC	10th CC	11th FC	11th CC	12th FC	12th CC
FC	CC	Mon.	6.0	0.5	5.0	0.5	5.0	0.5	3.0	1.0	3.0	N/D	3.0	0.5	6.0	0.5	closed.									
		Tues.																								
		Wed.																								
		Thur.																								
		Fri.																								
		Sat.																								
		Sun.																								

Record All Corrective Action(s) (if more space is needed, use the back of this form): 1/30/12 - 1oz of Dry Acid; 1/30/12 - 1oz of K-monopersulfate, 1/30/12 added 1oz of HypoCl

Test Kit

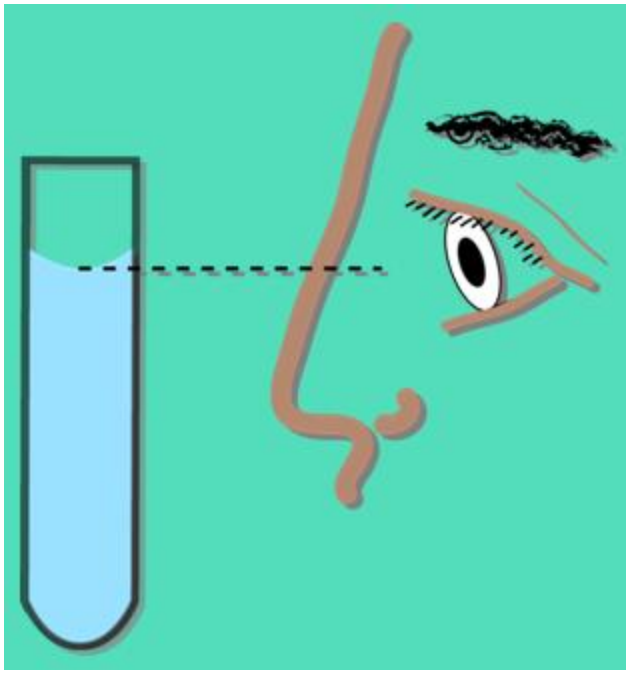
- Every pool operator must have a DPD-kit for testing:
  - pH
  - Free & combined chlorine or bromine
  - Total Alkalinity
  - Turbidity
  - Cyanuric Acid (if used)
  - Temperature

Titrimetric

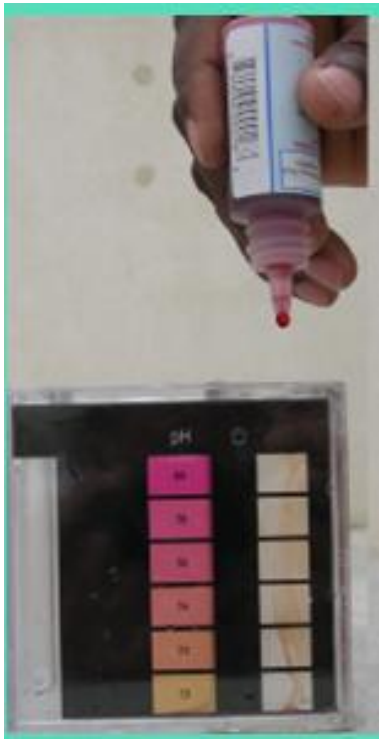
Recommend: Taylor® 'K-2006'

Colormetric Test Kits:

Drops & the Meniscus



Good



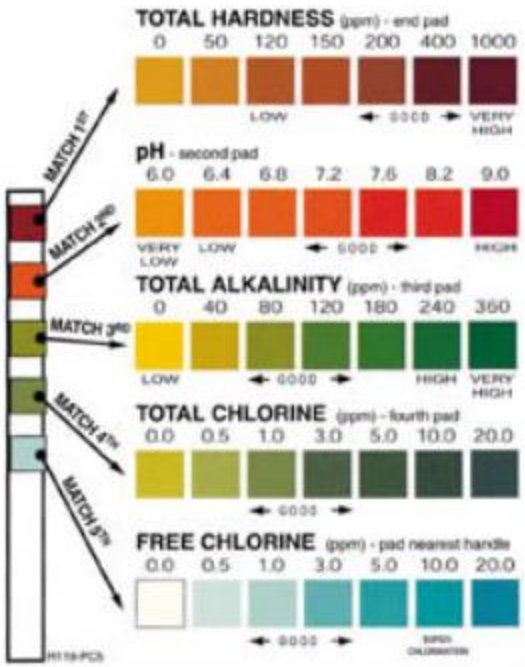
Bad

<u>Don't</u>:

- Alter the nipples
- Keep outdated reagents
- Leave reagents out in the sun
- Re-fill bottles

Test Strips

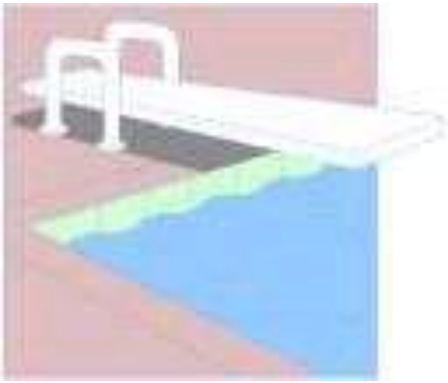
- Not recommended
  - Not accurate enough
- Allows for a quick easy test
  - Perhaps appropriate for quick checks when accompanied by DPD test soon after.



Any Questions?

Adjusting Water Quality Parameters

- **Knowing your pool**
  - How many gallons in your pool?



- **Understanding your chemicals**
  - Read the label
    - *"The Label is The Law"*

Algebra Refresher:

$$A \times B = C \longrightarrow \frac{A \times B}{C} = \frac{\cancel{C}}{\cancel{C}} \longrightarrow \frac{A \times B}{C} = 0$$

Algebra Refresher:

$$A \times B = C \longrightarrow \frac{A \times B}{C} = \frac{\cancel{C}}{\cancel{C}} \longrightarrow \frac{A \times B}{C} = 0$$

$$3 \times 5 = 15 \longrightarrow \frac{3 \times 5}{15} = \frac{\cancel{15}}{\cancel{15}} \longrightarrow \frac{3 \times 5}{15} = 0$$

Algebra Refresher:

$$A \times B = C$$

$$\frac{A \times B}{C} = 1$$

$$(A \times B) - C = 0$$

$$B = \frac{C}{A}$$

$$A = \frac{C}{B}$$

Algebra Refresher:

$$3 \times 5 = 15$$

$$\frac{3 \times 5}{15} = 1$$

$$(3 \times 5) - 15 = 0$$

$$5 = \frac{15}{3}$$

$$3 = \frac{15}{5}$$

Algebra Refresher:

1 ft^3 = 7.48 gallons

$$1000 ft^3 \times \frac{7.48 \text{ gal}}{ft^3} = \mathbf{7{,}480 \text{ gallons}}$$

1 ft^3 = 7.48 gallons

$$1000 \cancel{ft^3} \times \frac{7.48 \text{ gal}}{\cancel{ft^3}} = \mathbf{7{,}480 \text{ gallons}}$$

Algebra Refresher:

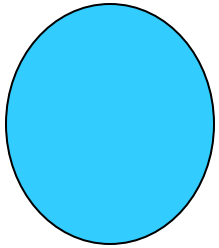
$$\frac{3.78541178 \text{ litres}}{1 \text{ US gallon}}$$

$$1{,}000 \text{ gal.} = \frac{3.8 \text{ litres}}{\text{gal.}} \times 1{,}000 \text{ gal.} = 3{,}800 \text{ litres}$$

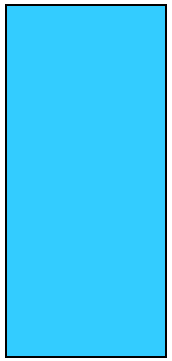
$$\frac{3.78541178 \text{ litres}}{1 \text{ US gallon}}$$

$$1{,}000 \text{ gal.} = \frac{3.8 \text{ litres}}{\cancel{\text{gal.}}} \times 1{,}000 \cancel{\text{gal.}} = 3{,}800 \text{ litres}$$

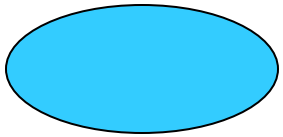
Measuring Pool Volume



- **Circular Pool**
  - $\pi r^2 \times$ Average Depth
    - 3.14 × radius × radius × Average Depth

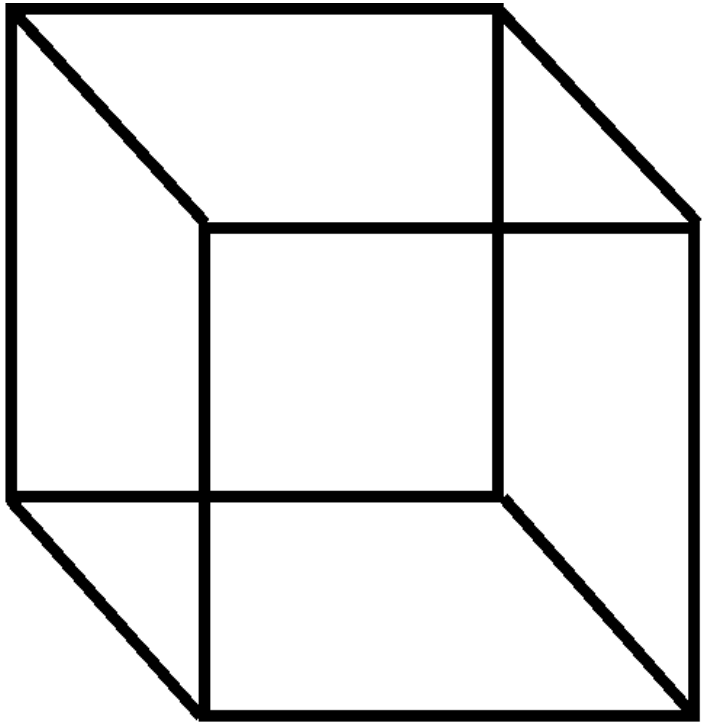


- **Rectangular Pool**
  - Length × Width × Average Depth (L×W×D)
- **Oval Pool**
  - π(½A)(½B) × Average Depth
    - A = length of long side, B = length of short side
    - 3.14 × (½ side ‘A’) × (½ side ‘B’) × Average Depth



Calculating Volume

Cube



10 Feet

L × W × H = Volume

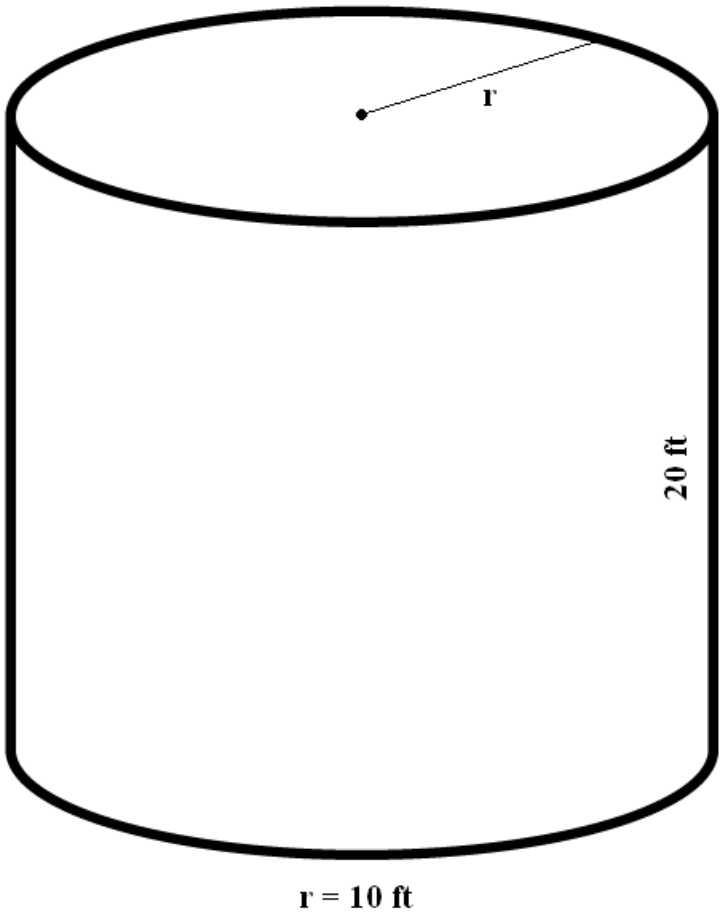
$10ft \times 10ft \times 10ft = 1{,}000ft^3$

$1\ ft^3 = 7.48$ gallons

$1000ft^3 \times 7.48\ gal/ft^3 =$ **7,480 gallons**

Calculating Volume

Cylinder



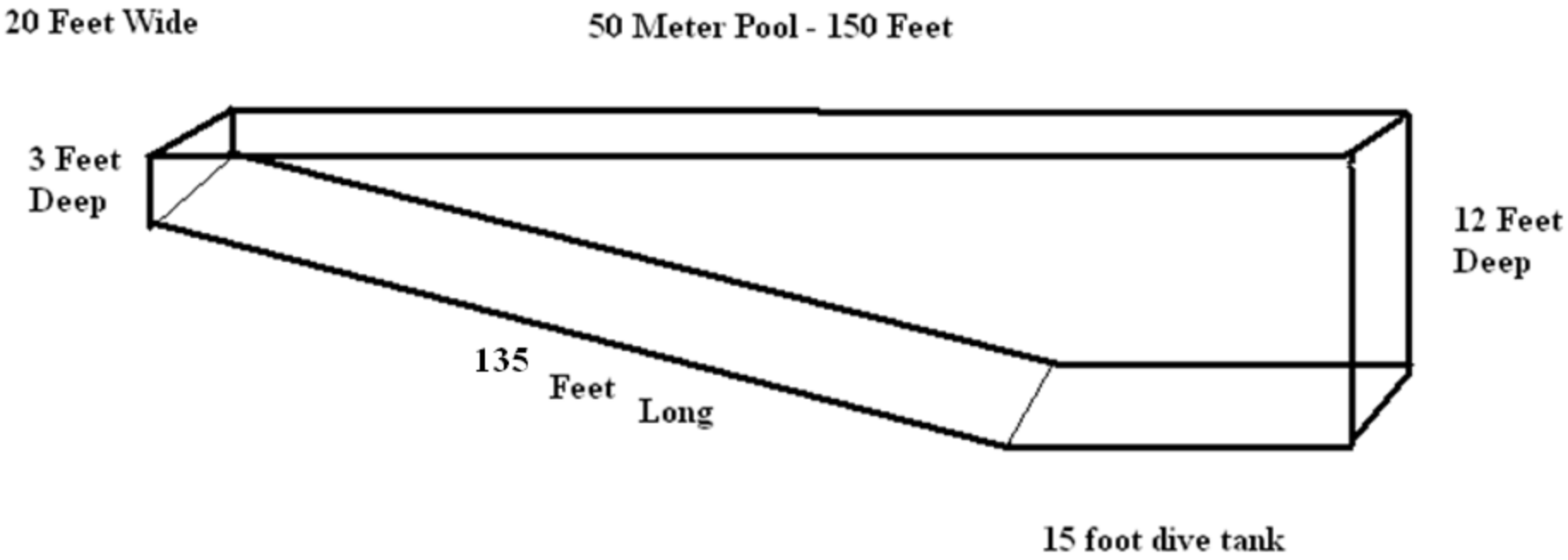
$\pi r^2 \times$ Depth = Volume

$3.14 \times 10\text{ft} \times 10\text{ft} \times 20\text{ft} = 6{,}280\text{ft}^3$

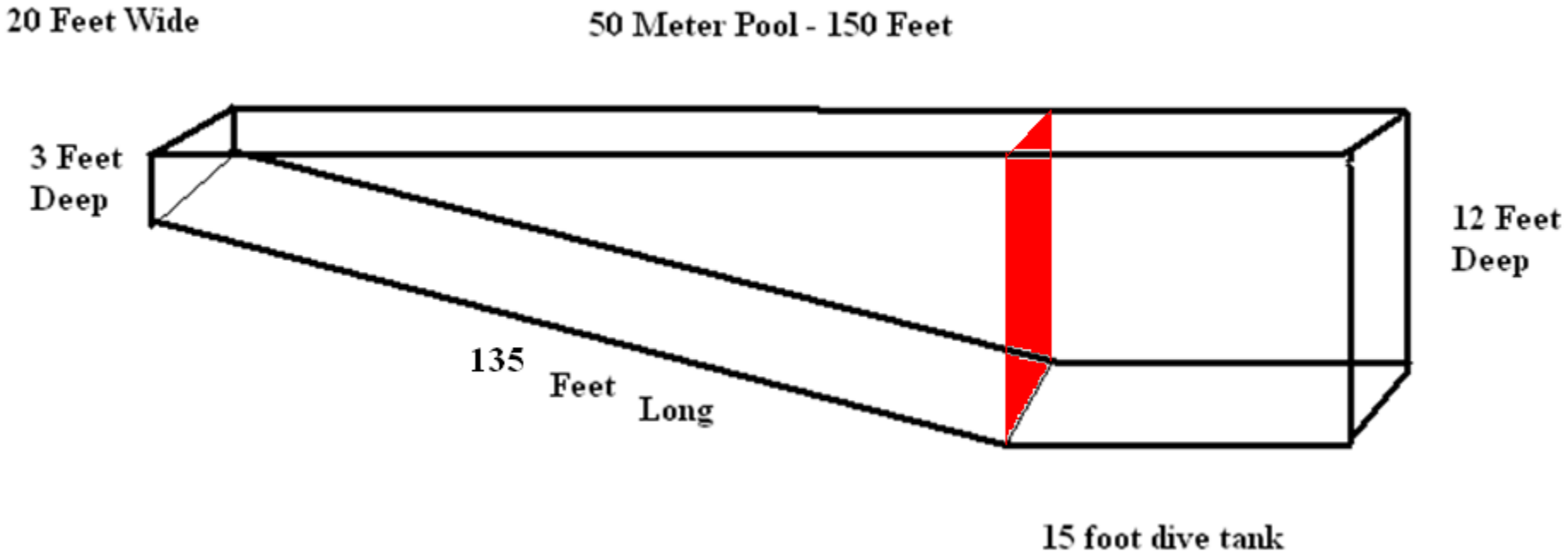
1 ft^3 = 7.48 gallons

$6{,}280\text{ft}^3 \times 7.48\ \text{gal/ft}^3 =$ **46,974.4 gallons**

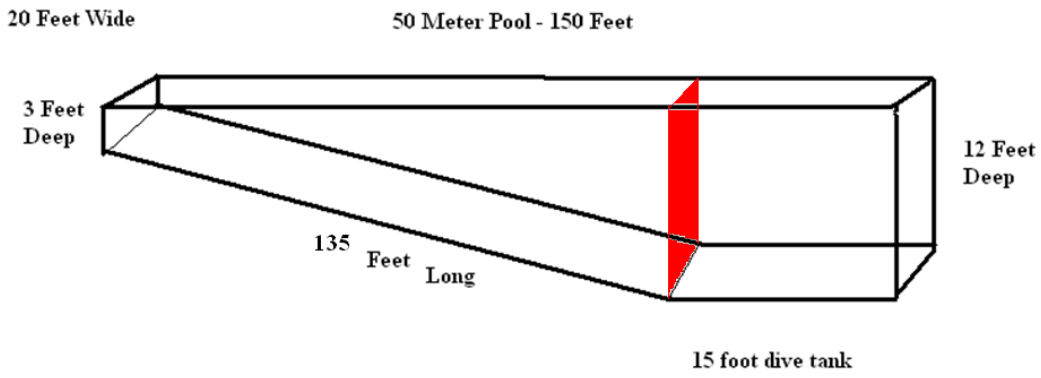
Measuring Pool Volume



Measuring Pool Volume

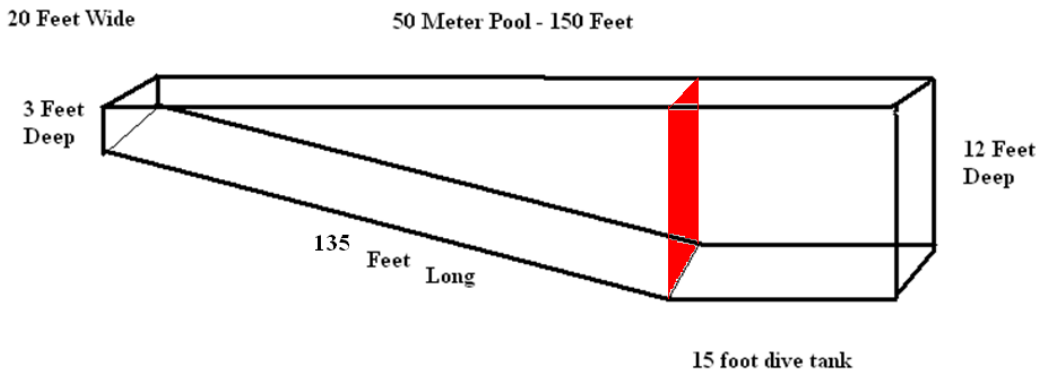


Measuring Pool Volume



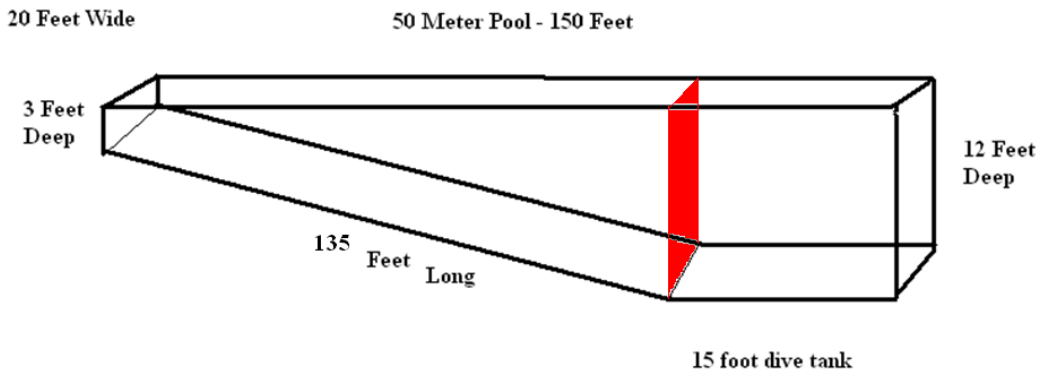
- **Describe sections of the pool using math:**
  - **Dive Tank:** *Depth* × *Length* × *Width* = **Volume^1**
  - **Rest of Pool:** *Width* × *Length* × [(*Shallow depth* + *Deep depth*) 2] = **Volume^2**
  - **Total Pool Volume = <u>Volume^1 + Volume^2 = Total Volume ft^3</u>**

Measuring Pool Volume



- **Describe sections of the pool using math:**
  - **Dive Tank:** 12’ × 15’ × 20’ = **?ft^3**
  - **Rest of Pool:** 20’ × 135’ × [(3’+12’) 2] = **?ft^3**
  - **Total Pool Volume = <u>?ft^3 + ?ft^3 = ?ft^3</u>**

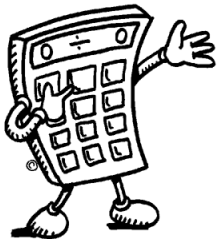
Measuring Pool Volume

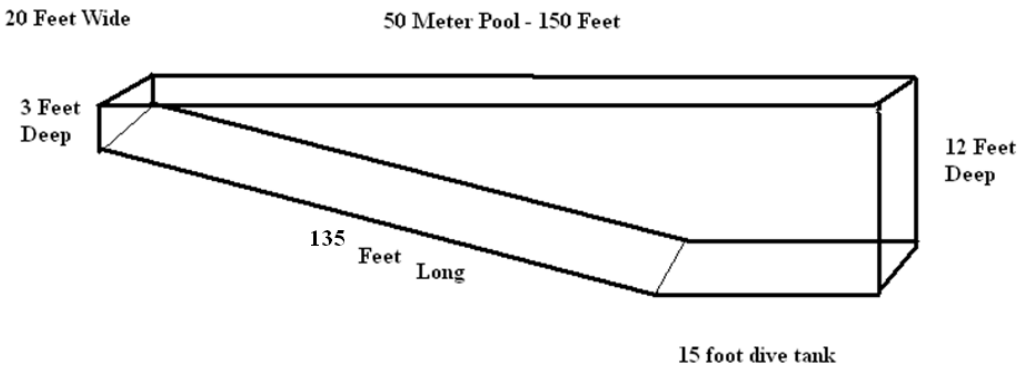


- **Make the calculations:**
  - **Dive Tank:** 12’ × 15’ × 20’ = **3,600 ft^3**
  - **Rest of Pool:** 20’ × 135’ × [(3’+12’) 2] = **20,250 ft^3**
  - **Total Pool Volume = <u>23,850 ft^3</u>**

Measuring Pool Volume

- **Converting Cubic Feet to Gallons**:
  - 1 ft^3 = 7.48 gallons

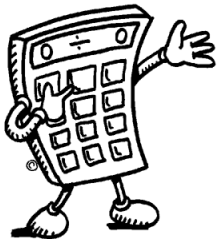


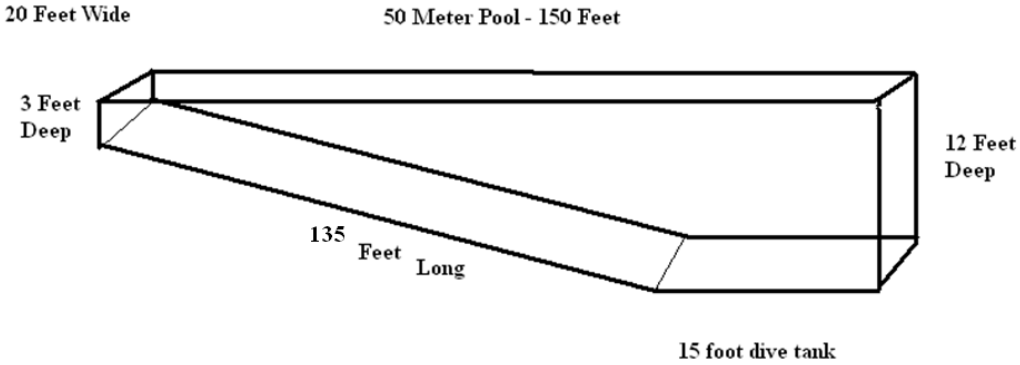


$$\text{Volume in gallons} = \frac{7.48 \text{ gallons}}{1 \text{ ft}^3} \times \frac{23{,}850 \text{ ft}^3}{1} = \underline{\textbf{? gallons}}$$

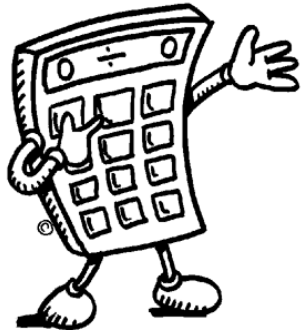
Measuring Pool Volume

- **Converting Cubic Feet to Gallons**:
  - 1 ft^3 = 7.48 gallons

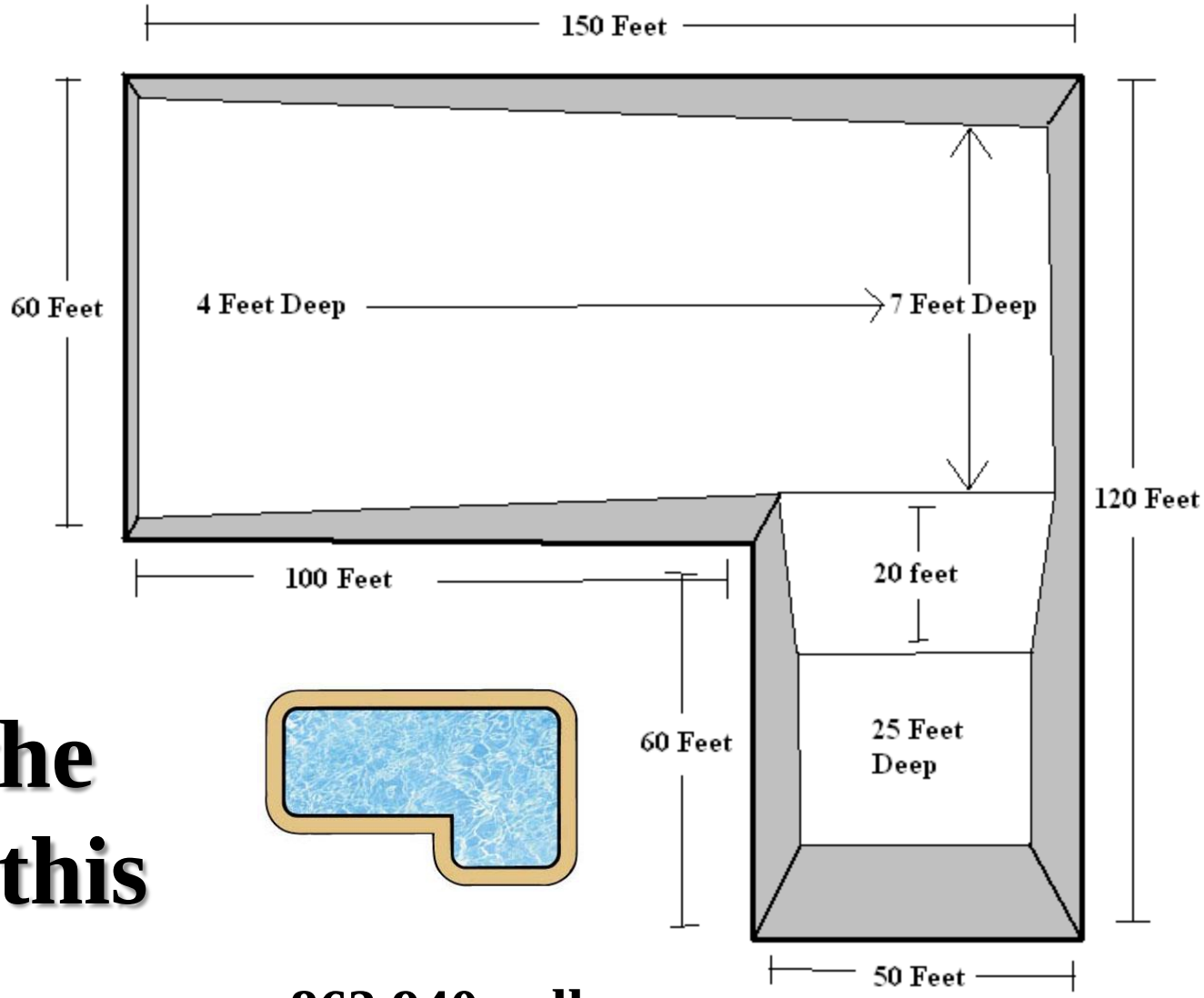




$$\text{Volume in gallons} = \frac{7.48 \text{ gallons}}{1\cancel{ft^3}} \times \frac{23{,}850\cancel{ft^3}}{1} = \underline{\mathbf{178{,}398 \text{ gallons}}}$$



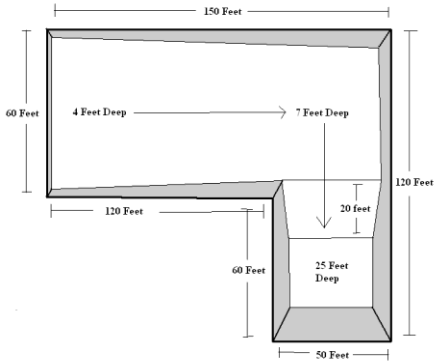
$L \times W \times Average\ Depth$



What is the volume of this pool?

863,940 gallons

Calculations:



$60' \times 150' \times [(4 + 7) \div 2] =$ **49,500 ft^3**

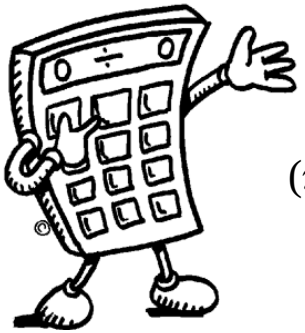
$50' \times 40' \times 25' =$ **50,000 ft^3**

$50' \times 20' \times [(7 + 25) \div 2] =$ **16,000 ft^3**

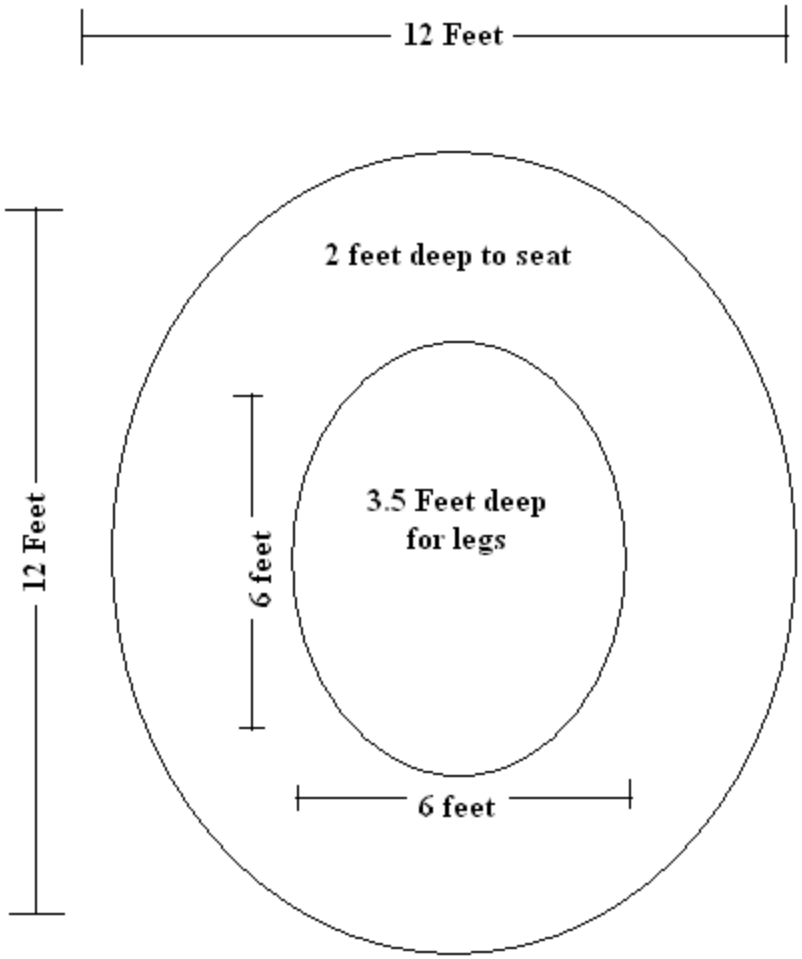
49,500 ft^3 + 50,000 ft^3 + 16,000 ft^3 = **115,500 ft^3**

115,500 ft^3 $\times$ 7.48 gal/ft^3 = **<u>863,940 gallons</u>**

* Try a Circle *



($\pi r^2 \times$ Average Depth)



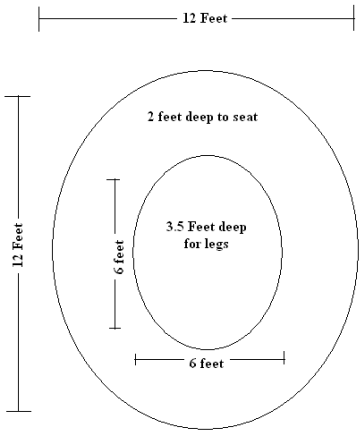
What is the volume of this spa?

2,005 gallons

Calculations:

$6' \times 6' \times 3.14 =$ **113 ft²**

$3' \times 3' \times 3.14 =$ **28.3 ft²**



$(113\ ft^2 - 28.3\ ft^2) \times 2' =$ **169 ft³**

$28.3\ ft^2 \times 3.5' =$ **99.1 ft³**

$169\ ft^3 + 99.1\ ft^3 =$ **268.1 ft³**

$268.1\ ft^3 \times 7.48\ gal/ft^3 =$ **<u>2,005 gallons</u>**

Read The Label!

- Federal law requires that every chemical product be labeled with directions on it's safe use.
  - Intended use
  - Correct dose
  - Safe handling
  - Etc.

Material Safety Data Sheet (MSDS)

For all hazardous chemicals

Readily available during normal work hours

Immediately accessible during emergencies

Providing the MSDS:

- Initial shipment
- First shipment after update

Baby Steps…

- Adjust one parameter at a time
  - Make small changes and take notes.
- Consider the relationships between each chemical

Baby Steps…

- pH & Water Balance Problems:
  - Change Alkalinity First
- Cyanuric Acid can cause a false reading for Alkalinity measurements.
  - Subtract ⅓ of the cyanuric measurement from the alkalinity measurement to calculate true alkalinity.

Baby Steps…

- High chlorine concentrations (>10ppm) will interfere with measurements:
  - Purple indicator on pH test
  - Bleach out indicator for chlorine tests
- Add extra R-007 (*Thiosulfate N/10*)
  - Green Bottle

Making the Changes:

- Adjusting the pool by 1.0 ppm of chlorine

	Volume of Water						
% Available Chlorine	**400 Gallons**	**1,000 Gallons**	**5,000 Gallons**	**10,000 gallons**	**20,000 Gallons**	**50,000 Gallons**	**100,000 Gallons**
10 %	0.51 fl oz	1.28 fl oz	6.40 fl oz	12.8 fl oz	1.60 pt	2.00 qt	1.00 gal
12 %	0.43 fl oz	1.07 fl oz	5.33 fl oz	10.7 fl oz	1.33 pt	1.67 qt	3.33 qt
35 %	0.15 oz	0.38 oz	1.91 oz	3.82 oz	7.63 oz	1.19 lb	2.38 lb
45 %	0.12 oz	0.30 oz	1.48 oz	2.97 oz	5.94 oz	14.8 oz	1.85 lb
60 %	0.09 oz	0.22 oz	1.11 oz	2.23 oz	4.45 oz	11.1 oz	1.39 lb
65 %	0.08 oz	0.21 oz	1.03 oz	2.05 oz	4.11 oz	10.3 oz	1.28 lb
75 %	0.07 oz	0.20 oz	0.95 oz	1.77 oz	3.77 oz	9.50 oz	1.17 lb
90 %	0.06 oz	0.15 oz	0.74 oz	1.48 oz	2.97 oz	7.42 oz	14.8 oz
100 %	0.05 oz	0.13 oz	0.67 oz	1.34 oz	2.67 oz	6.68 oz	13.4 oz

Making the Changes:

- What type of chemical are you using?
- How big is the pool?
- How much do you want to change the chlorine level?

	Volume of Water						
% Available Chlorine	**400 Gallons**	**1,000 Gallons**	**5,000 Gallons**	**10,000 gallons**	**20,000 Gallons**	**50,000 Gallons**	**100,000 Gallons**
10 %	0.51 fl oz	1.28 fl oz	6.40 fl oz	12.8 fl oz	1.60 pt	2.00 qt	1.00 gal
12 %	0.43 fl oz	1.07 fl oz	5.33 fl oz	10.7 fl oz	1.33 pt	1.67 qt	3.33 qt
35 %	0.15 oz	0.38 oz	1.91 oz	3.82 oz	7.63 oz	1.19 lb	2.38 lb
45 %	0.12 oz	0.30 oz	1.48 oz	2.97 oz	5.94 oz	14.8 oz	1.85 lb
60 %	0.09 oz	0.22 oz	1.11 oz	2.23 oz	4.45 oz	11.1 oz	1.39 lb
65 %	0.08 oz	0.21 oz	1.03 oz	2.05 oz	4.11 oz	10.3 oz	1.28 lb
75 %	0.07 oz	0.20 oz	0.95 oz	1.77 oz	3.77 oz	9.50 oz	1.17 lb
90 %	0.06 oz	0.15 oz	0.74 oz	1.48 oz	2.97 oz	7.42 oz	14.8 oz
100 %	0.05 oz	0.13 oz	0.67 oz	1.34 oz	2.67 oz	6.68 oz	13.4 oz

Any Questions?

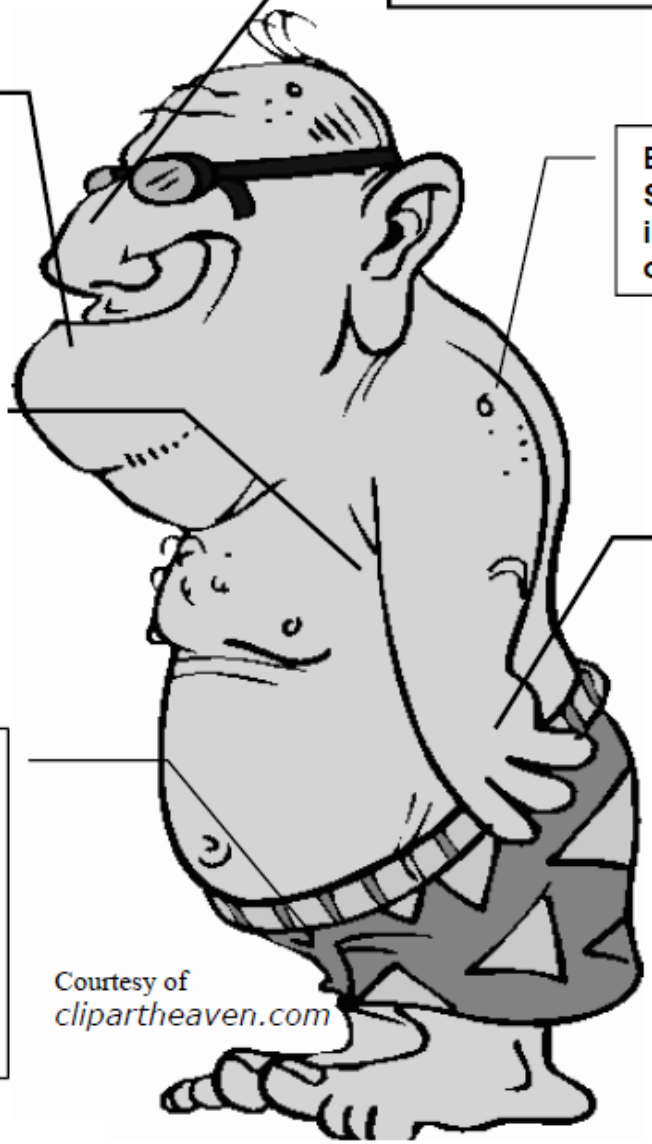
Pool/ Spa Operation

Ironically, we build pools to promote health, fitness and safety. However, several risks and hazards are produced with the construction of swimming facilities.

Good pool facility operators always aim to have safe, enjoyable and clean swimming pools. This is achieved by ensuring compliance with all relevant codes and following simple commonsense principals.

No pool can be made safe without the thoughtful and knowledgeable oversight of a skilled operator!

"The real problem with swimming pools is that we let people in them…"



Up to 36,000 Microorganisms with clearing the nose

From 100 million to 1 billion organisms from 1 gram of saliva

Boils and infections Source of highly infective diease organisms

Perspiration (active swimmer) 2 pints per hour.

Hands may have ½ to 5 million organisms shed with one washing

Area under the swimsuit has an excessive number of organisms and organic material to shed in the pool if without adequate bathing before entering the pool

There are some things you would rather NOT share.

Shower before swimming.

Healthy Swimming

www.cdc.gov/healthyswimming

CDC

Help keep the pool clean

Please wash your child thoroughly (especially the rear end) with soap and water *before* swimming.

www.cdc.gov/healthyswimming

CDC

Showers?

- How far away?
- Is soap provided?
- Is there a sign?

  OAR: 333-060-0215(b)(B):

  "SHOWER YOUR CHILD AND YOURSELF. Take a cleansing shower before entering the pool or after using the toilet."

  OAR: 333-62-180(1)

  "STOP All persons are required to take a cleansing shower before entering the spa pool."

- Privacy?
- Enforcement?

Showers?

- A 2011 Study *(University of Michigan)* asked 865 parents with children 5 to 12 years old
  - Only 26 percent of those polled felt it was important to shower before getting into the water.
  - Only 15 percent of those same parents felt there was a high risk of children getting sick from pool water.
  - At the same time, 64 percent felt it was very important for children not to swallow water at water parks.
- A 2010 study *(University of Illinois)* found when people get into the pool with their make-up or sunscreen on, or if they urinate in the pool, these substances mix with the pools disinfectants.
  - Long-term exposure to the resulting chemicals may mutate genes, cause birth defects, accelerate the aging process, cause breathing problems and could lead to cancer.

http://www.9news.com/news/article/204531/164/Most-people-dont-shower-before-swimming-in-a-public-pool

Discussion

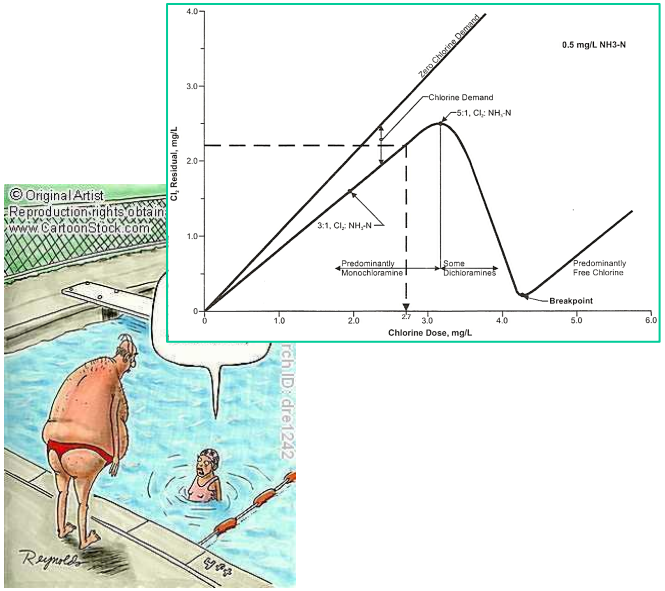
- How do we motivate swimmers to shower <u>before</u> entering the pool/spa?

When to close the facility:

- pH is too high or too low
- No disinfectant
  - Chlorine, Bromine
- Poop in the pool
- Cloudy Water (Turbid)
- Water temperature is too hot (>104ºF)
- No supervision
- Dangerous situation
  - Lightning, etc.
- Pool maintenance:
  - Superchlorination, (Breakpoint chlorination), backwashing the filter, draining the pool, etc.
- Mechanical failure
- Virginia Graeme Baker Act
  - December 19, 2009
  - 333-060-0128(3); *333-062-0103(1)(d)*
    - *"BROKEN OR MISSING GRATE FITTINGS. If the pool operator finds that a suction fitting is broken or missing, they must close the pool immediately, shut down the recirculation system and remain closed until the fitting has been replaced."*

Breakpoint Chlorination

- Other Names:
  - Shock
  - Superchlorination
- Destroys Chloramines
- Oxidizes organic material
- Sanitizes the pool



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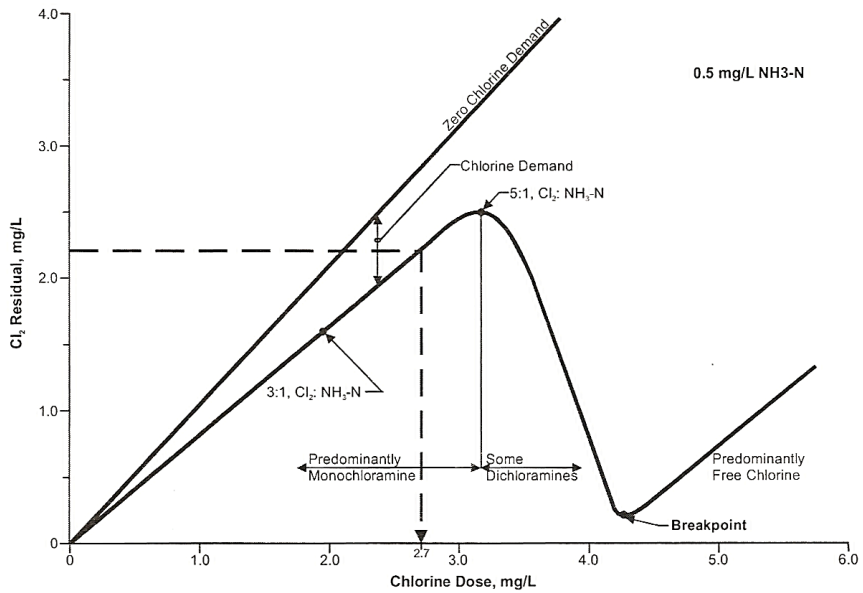
Breakpoint Chlorination

- Breakpoint:
  - Point when Chloramines are destroyed
- Multiply Combined Chlorine (CC) measure in ppm by a factor of 10
- Raise Free Chlorine FC by that many ppm
  - *May have to close the pool for 8 – 10 hours.*



Breakpoint Chlorination

- Treat when CC levels reach 0.2 - 0.4 ppm
- Always better to over chlorinate than under
  - Under-doses can increase CC
- Converts CC to Nitrogen (harmless gas)
  - *Remember to open windows, remove covers, etc.*

Breakpoint Chlorination

- Example 1:
  - CC = 0.4 ppm in an 50,000 gal. Pool
  - 10 × 0.4 ppm = 4.0 ppm

- Calculate amount of chemical needed to raise a 50,000 gal. pool by 4.0 ppm
  - Sodium Hypochlorite (65%) = 41.2 oz of powdered chemical = 5.15 cups
    - Let's add 6 cups to ensure complete breakpoint chlorination

Breakpoint Chlorination

- **Emerging Science:**
  - Concerns with the formation of ‘Disinfection By-Products’ from high levels of chlorine during breakpoint chlorination.
    - Risks from: haloacetic acids, haloacetonitriles, haloketones, and chlorophenols
  - Hood River County Health Department recommends treating combined chloramines early so that excessive chlorine levels do not need to be reached.
    - More guidelines will follow in years to come.

Non-Chlorine Oxidizing Treatment

- Potassium Monopersulfate
  - Oxygen based chemical
  - Destroys chloramines and organic wastes
  - Swimmers can return to the water within 1 hour
  - Must have special test-kit with a ‘deox’ reagent
    - Skews ‘Free’ and ‘combined’ Chlorine measurements.
    - Available from Taylor®

Water Balance

Protecting your equipment

Water Balance

- **Langelier Index** – Saturation Index (SI)
  - Aggressive Water
    - Corrosive
  - Scaling Water
    - Clogs & Clouds

Formula:

(pH, Temperature, Calcium Hardness, Total Alkalinity)

- SI = pH + TF + CF + AF + (-12.1)
  - Balanced = range of: (-0.5) – 0.5

Langelier SI Table

Temperature		Calcium Hardness		Total Alkalinity	
ºF =	TF	ppm =	CF	ppm =	AF
32	0	5	0.3	5	0.7
37	0.1	25	1.0	25	1.4
46	0.2	50	1.3	50	1.7
53	0.3	75	1.5	75	1.9
60	0.4	100	1.6	100	2.0
66	0.5	150	1.8	150	2.2
76	0.6	200	1.9	200	2.3
84	0.7	300	2.1	300	2.5
94	0.8	400	2.2	400	2.6
105	0.9	800	2.5	800	2.9
Too	Hot!	1000	2.6	1000	3.0

Example 1

- pH = 7.8
- Alkalinity 200 ppm
- Calcium Hardness 400 ppm
- Temperature 86ºF

Example 1

Temperature		Calcium Hardness		Total Alkalinity	
ºF =	TF	ppm =	CF	ppm =	AF
32	0	5	0.3	5	0.7
37	0.1	25	1.0	25	1.4
46	0.2	50	1.3	50	1.7
53	0.3	75	1.5	75	1.9
60	0.4	100	1.6	100	2.0
66	0.5	150	1.8	150	2.2
76	0.6	200	1.9	**200**	**2.3**
84	**0.7**	300	2.1	300	2.5
94	0.8	**400**	**2.2**	400	2.6
105	0.9	800	2.5	800	2.9
Too	Hot!	1000	2.6	1000	3.0

Example 1

SI = 7.8 + 0.7 + 2.2 + 2.3 - 12.1 = +0.9

- **This pool has water that is too basic (Scaling)**
  - Reduce Alkalinity & pH by adding muriatic acid.
    - Reduce Alkalinity to 150
    - Reduce to 7.3 pH
  - SI = +0.3
  - OAR: 333-060-0200 – requires pH be: 7.2 – 7.6

Example 2

- pH = 7.0
- Alkalinity 50 ppm
- Calcium Hardness 30 ppm
- Temperature 78ºF

Example 2

Temperature		Calcium Hardness		Total Alkalinity	
ºF =	TF	ppm =	CF	ppm =	AF
32	0	5	0.3	5	0.7
37	0.1	**25**	**1.0**	25	1.4
46	0.2	50	1.3	**50**	**1.7**
53	0.3	75	1.5	75	1.9
60	0.4	100	1.6	100	2.0
66	0.5	150	1.8	150	2.2
76	**0.6**	200	1.9	200	2.3
84	0.7	300	2.1	300	2.5
94	0.8	400	2.2	400	2.6
105	0.9	800	2.5	800	2.9
Too	Hot!	1000	2.6	1000	3.0

Example 2

SI = 7.0 + 0.6 + 1.7 + 1.0 - 12.1 = (-1.8)

- This pool is corrosive
  - Start by raising Calcium Hardness by adding "calcium chloride dehydrate"
  - You may also have to:
    - Raise Total Alkalinity by adding Sodium Bicarbonate (baking soda)
    - Raise pH by adding sodium carbonate (Soda Ash)

A Quiet Day At The Pool

or why we have a job.

Bather Load

Pool:

Size 333-060-0055
Public swimming pools shall be sized according to and shall not exceed the design limit of the user load functions shown below. User loads are specific in-pool loads only. Area of deep water, "D" equals the surface area of the pool greater than five feet (1.5m) deep. Area of shallow water, "S" equals the surface area of the pool less than five feet (1.5m) deep. Surface area, "A" equals the area of the entire pool.

(1) Outdoor swimming pools:

Max. load = (D / 27) + (S / 15)
(>2000 square feet)
Max. load = A / 24
(<2000 square feet)

(2) Indoor swimming pools. **Max. load = A / 24**

(3) Spray pools, wading pools. **Max. load = A / 24**

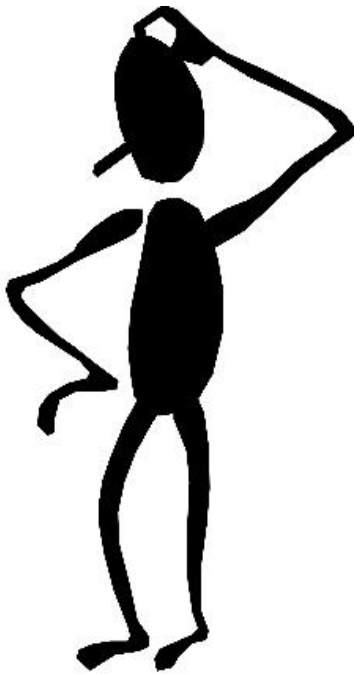
Spa:

Size 333-62-050
Public spa pools shall be sized according to and shall not exceed the design limit of the bather load function shown below. Bather loads are specific in-tank loads only.

Maximum Load = A / 10

Where A equals the surface area of the public spa pool in square feet.

Bather Load



- Pool:
  - 20 ft × 40 ft = Area
  - Ranges 3.5 ft – 8 ft deep

What is the bather load?

Bather Load

- **Pool:**
  - 20 ft × 40 ft = **<u>800 ft²</u>**
  - Ranges 3.5 ft – 8 ft deep

800 ft² ÷ 24 = 33.33

<u>Maximum of 33 people in the Pool</u>

Bather Load

- **Bather Load Equivalents:**
  - 1 dog = ~ 50 people
  - 1 duck = ~ 5 people

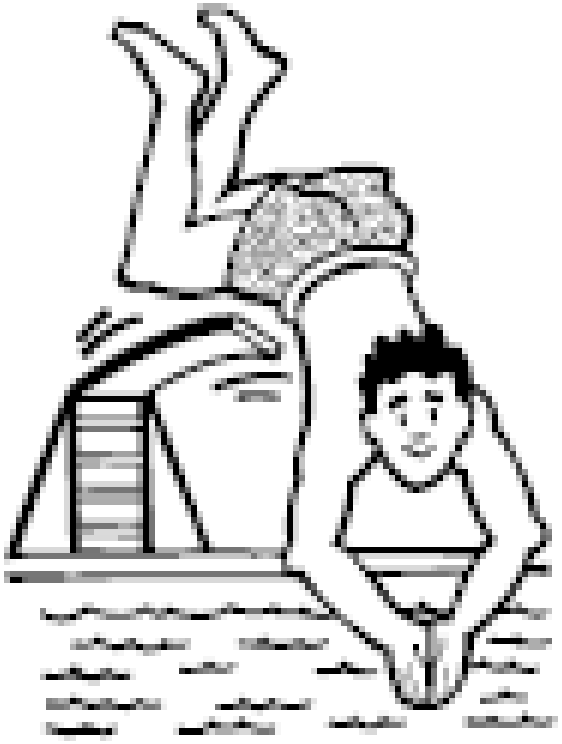
Any Questions?

Recognizing safety, supervision and risk management issues

"Hey, watch me jump!"

Causes of Swimmer Injuries

- Slips & Falls
  - Running
- Diving into shallow water
- Slide accidents
- Improper use of equipment
- Equipment failure
- Electrical Burns/hot water burns
- Hyperthermia & Hypothermia



Drowning

- Drowning is 2nd leading cause of death among children in the USA. (1-14 yrs)
- Most drowning occur in private swimming pools
- Out of sight for less than 5 minutes

10 Leading Causes of Unintentional Injury Deaths, United States

2006, All Races, Both Sexes

Ages: 1-4

Cause of Death	Number of Deaths	Percentage of All Deaths in Age Group
All Unintentional Injury Deaths	1,610	
Unintentional MV Traffic	471	29.3%
Unintentional Drowning	458	28.4%
Unintentional Fire/burn	202	12.5%
Unintentional Suffocation	137	8.5%
Unintentional Pedestrian, Other	113	7.0%
Unintentional Fall	38	2.4%
Unintentional Natural/ Environment	37	2.3%
Unintentional Struck by or Against	33	2.0%
Unintentional Poisoning	27	1.7%
Unintentional Other Spec., classifiable	18	1.1%
All Others	76	4.7%

WISQARS:
http://webappa.cdc.gov/cgi-bin/broker.exe?_service=v8prod&_server=app-v-ehip-wisq.cdc.gov&_port=5081&_sessionid=k85.M9EZL52&_program=wisqars.percents10.sas&age1=1&age2=4&agetext=1-4&category=UNI&_debug=0 - 2/23/10

10 Leading Causes of Unintentional Injury Deaths, United States

2006, All Races, Both Sexes

Ages: 5-10

Cause of Death	Number of Deaths	Percentage of All Deaths in Age Group
All Unintentional Injury Deaths	1,231	
Unintentional MV Traffic	629	51.1%
Unintentional Drowning	155	12.6%
Unintentional Fire/burn	132	10.7%
Unintentional Other Land Transport	63	5.1%
Unintentional Suffocation	55	4.5%
Unintentional Pedestrian, Other	24	1.9%
Unintentional Other Transport	23	1.9%
Unintentional Poisoning	22	1.8%
Unintentional Firearm	20	1.6%
Unintentional Other Spec., classifiable	20	1.6%
All Others	88	7.1%

WISQARS:
http://webappa.cdc.gov/cgi-bin/broker.exe?_service=v8prod&_server=app-v-ehip-wisq.cdc.gov&_port=5082&_sessionid=2MZti8EZL52&_program=wisqars.percents10.sas&age1=5&age2=10&agetext=5-10&category=UNI&_debug=0 - 2/23/10

Drowning

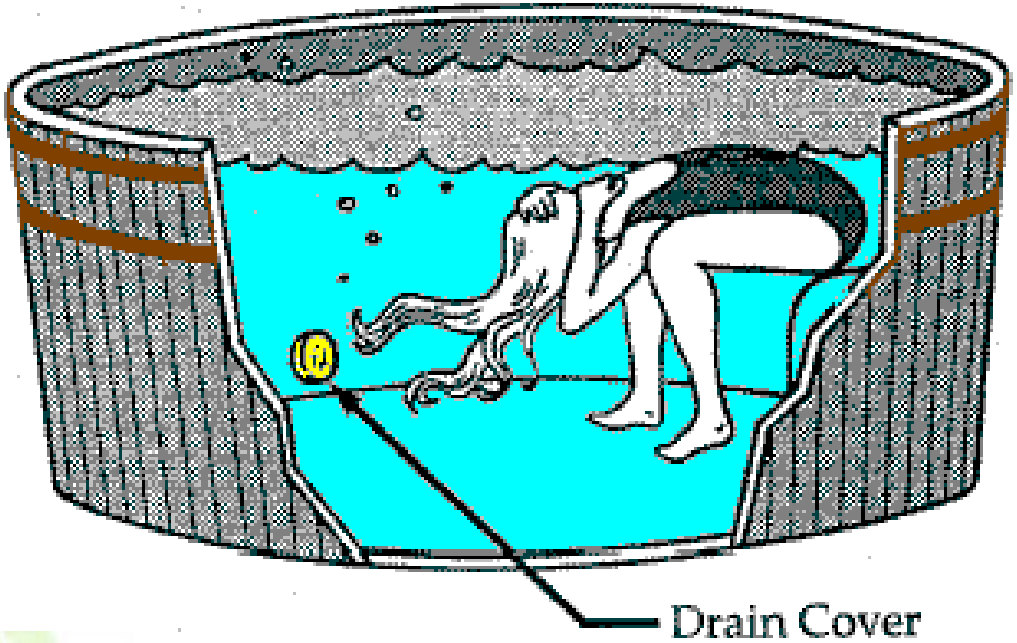
- **2006 = 458 deaths (1-4 yrs)**
- For every drowning death:
  - 5 more required emergency care (~2290 pp)
    - ½ require hospitalization (~1145 pp)
  - Can cause brain damage
  - Long-term disabilities
    - Memory loss, learning disabilities, vegetative state

- **Liability?**

Entrapment

- **Virginia Graeme Baker Act:**
  - Consumer Product Safety Commission
    - Required to reach compliance by: December 19th, 2009
    - Very strong penalties
      - Millions of dollars!
  - High exposure to liability
    - Law suits

This is a big deal!



Enforcement Status

- Oregon Counties do not have the authority to enforce the new rules on existing pools.

- CPSC – is the responsible agency
  - They simply levy fines (millions!).

Enforcement Status

333-062-0103 - Submerged Suction Fittings and Drains

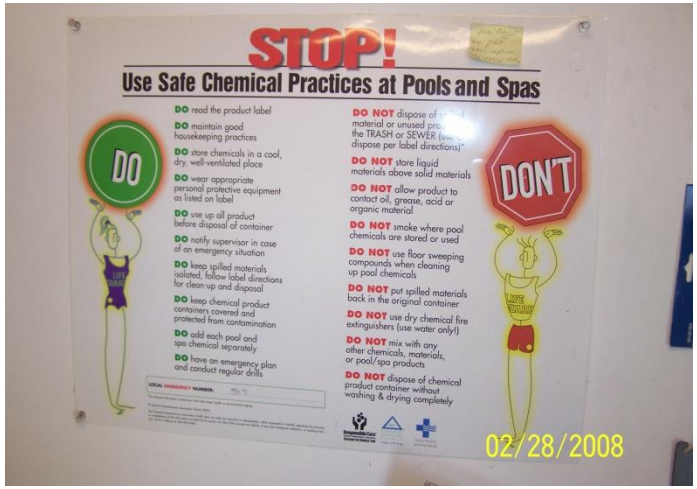
"The provisions in this rule are consistent with the requirements of the federal Virginia Graeme Baker Pool and Spa Safety Act (VGBPSSA), 15 USC 8001. Public swimming pools, wading pools and spas that operate year-round were expected to be in compliance by December 19, 2008. Seasonal public swimming pools, wading pools and spas that were closed when the law went into effect are expected to be in compliance with the federal law on the day that they reopen in 2009. The U.S. Consumer Product Safety Commission (CPSC) is responsible for enforcing the VGBPSSA. This rule will not be enforced by the state or a county delegated authority under ORS 448.100 against public swimming pools, wading pools and spas built prior to the effective date of this rule as the 13 Revised – December 23, 2009 state is not responsible for enforcement of the VGBPSSA. However, any public pool or spa not in compliance with the VGBPSSA could be subject to an enforcement action by the CPSC."

Preventative Measures

- **Required By State Code:**
  - Depth markings
  - Warning signs
  - Control access (fence)
  - Regular maintenance
  - Provide supervision
  - First aid kit
  - First aid certification
    - Lifeguard training

Signs

- OAR: 333-060-0215
- OAR: 333-062-0180

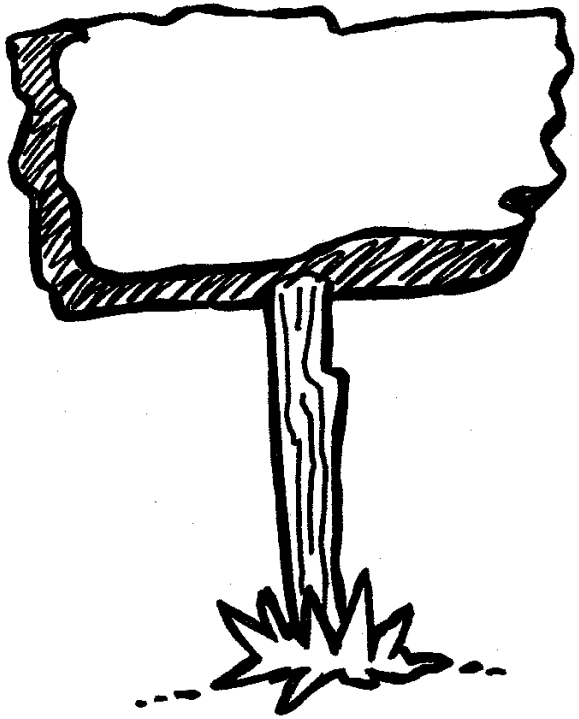


Signs: Spa

Signs shall be a minimum of 24" x 18" with letters at least 3/8" in height.

OAR: 333-62-180(1)

"STOP All persons are required to take a cleansing shower before entering the spa pool."



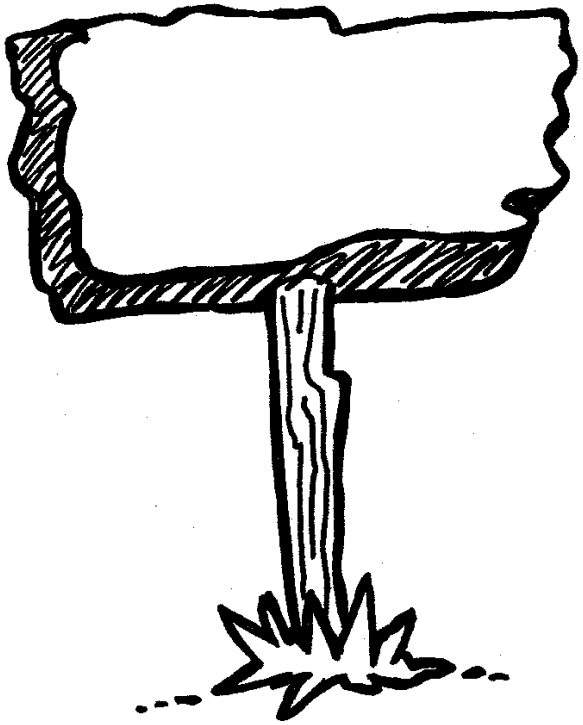
Signs: Spa

Signs shall be a minimum of 24" x 18" with letters at least 3/8" in height.

OAR: 333-62-180(1)

CAUTION

- Elderly persons and those suffering from heart disease, diabetes or high blood pressure should consult their physician before using the spa pool. No person suffering from a communicable disease, transmissible via water, shall use the spa pool. Persons using prescription medications should consult their physician before using the spa pool.
- Individuals under the influence of alcohol should not use the spa pool.
- No person shall use the spa pool alone.
- Pregnant women should not use the spa pool without consulting their Physician.
- Persons should spend no more than 15 minutes in the spa at any one session.
- All children under 14 years of age shall be accompanied by a responsible adult observer.
- No person shall run or engage in horseplay in or around the spa pool.



Signs: Pool

Signs shall be a minimum of 24" x 18" with letters at least ½" in height.

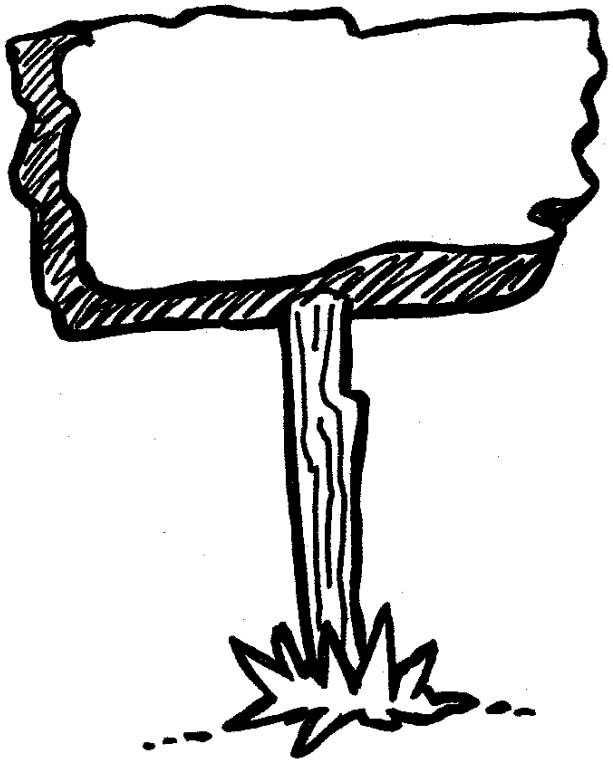
OAR: 333-060-0215(2)(a)

At pools where lifeguards are not provided:

(A) "NO LIFEGUARD ON DUTY" (In letters at least 4 inches high.)

(B) "BRING A FRIEND - Do not swim alone."

(C) "CHILDREN UNDER 14 - BRING AN ADULT. Non-swimmers and children under 14 years of age need responsible adult supervision."



Signs: Pool

Signs shall be a minimum of 24" x 18" with letters at least ½" in height.

OAR: 333-060-0215(2)(b)

At all pools:

(A) "PROTECT OUR WATER - Please do not use the pool if you have had diarrhea in the past two weeks, or a disease communicable by water."

(B) "SHOWER YOUR CHILD AND YOURSELF. Take a cleansing shower before entering the pool or after using the toilet."

(C) "Swimmers who are not toilet trained must wear a swim diaper."

(D) "Immuno-compromised individuals should use caution when using a public pool."

(E) "WATER AND ALCOHOL DON'T MIX. No person under the influence of alcohol may use the pool."

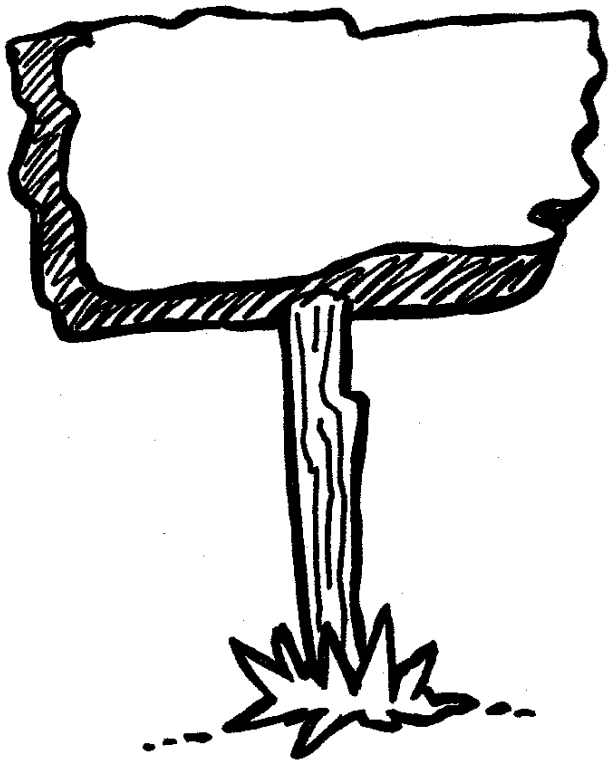
(F) "NO RUNNING or ROUGH PLAY."

(G) "NO GLASS OR PLASTIC THAT WILL SHATTER."

(H) "NO FOOD or DRINK in the pool."

(I) "NO DIVING ALLOWED", or "NO DIVING, except in designated diving areas."

(J) "NO ANIMALS in the pool area."



Surveillance

- **Limited Use Pool/spa:**
  - Monitor pool area as often as chemical testing is required.
- **General Use Pool:**
  - Lifeguard required

Emergency Event

- Dial 911
- Initiate Emergency Action Plan
  - You need a plan!
- **Emergency Response Plans (ERP)**

OAR: 333-060-0210(2)
TELEPHONE. The operator must provide a telephone that is accessible during all hours the pool is open for operation. The phone must be capable of reaching emergency assistance without the use of cards or coins. The operator must conspicuously post, within the pool area, the address of the pool facility.

First Aid Kit

- **AED:**
  - Automatic pulmonary defibrillator
  - Talk of making this required by state code
  - Have saved several lives throughout USA
- Be ready for anything

First Aid Kit

333-060-0210(3)(d) First Aid Supplies.

"All general-use public pools must have a first aid kit, supplied with at least the items in Appendix A. The kit must be stored in an area close to the pool, where it is accessible for use. The operator must keep the kit supplied and not allow it to deteriorate.

333-060-0210 - Appendix A:

- Supplies to be included in the first aid kit:
- First Aid pocket guide
- supply checklist
- assorted sterile gauze pads (4x4, 3x3, 5x9, etc.) with adhesive tape
- antiseptic wipes or hydrogen peroxide
- scissors
- tweezers
- triangular bandages
- roller gauze
- Blood-borne pathogen spill kit
- disposable single use gloves
- eye protection, face shields, or goggles
- first aid pocket masks as a barrier for rescue breathing or CPR
- space blanket
- small trash bag or biohazard bag

Reaching Equipment

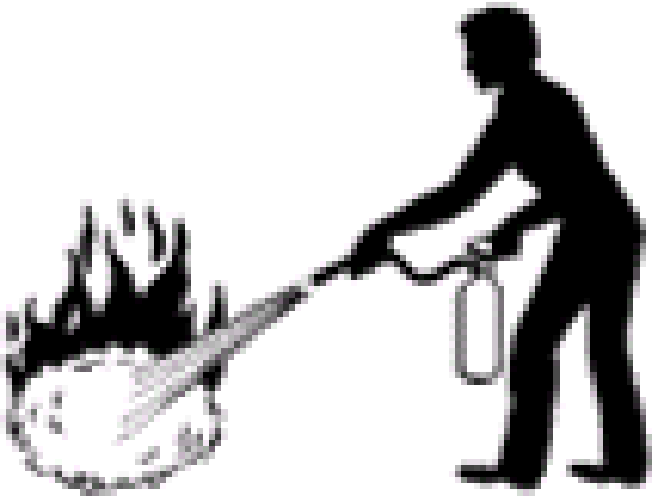
- Stay dry, save a life
- Safer than entering the pool to rescue someone
- Fast

Other Items

- Back Board
  - Only for EMTs and Lifeguards
- Life Ring
  - 30 foot rope must be attached.

Fire

- Some of the pool chemicals can catch fire when mixed!



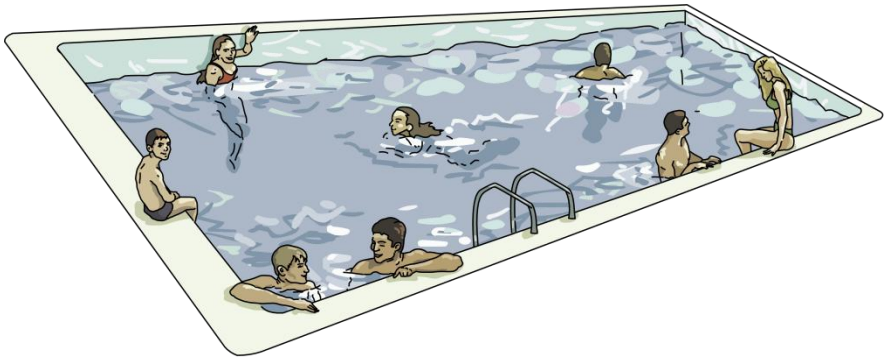
Awareness

- Do not allow repetition and boredom to influence awareness
  - Keep on and off duty shifts short
    - No more than 45 minutes

Any Questions?

Time Constraints

- Has time been set aside for you to successfully complete all required tasks as a pool operator?

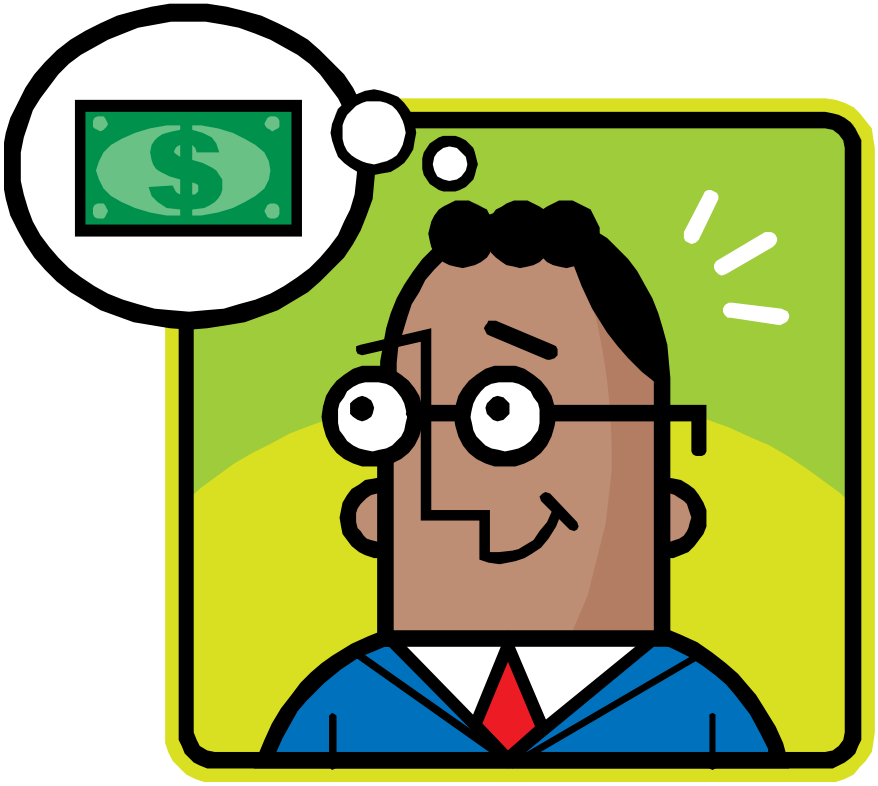


Serious Considerations

Are staff available during all operating hours?

What do you need to be successful?

Do you have support from management?



Americans With Disabilities Act (ADA)

- New guidelines on January 31st, 2013
  - Apply to both private and public facilities if open to the general public.

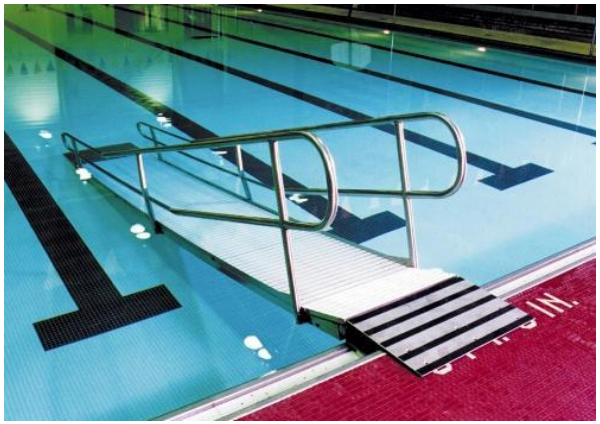
Full details at:

http://www.ada.gov/2010ADAstandards_index.htm
http://www.ada.gov/pools_2010.htm

No grandfather clause!

You must have an approved plan, with documented budgetary considerations and installation schedule by 2/31/13!

- For all pools & spas:
  - At least 1 access facility
    - Lifts
    - Pass over
    - Etc.



Any Questions?

Communicable Diseases
&
Preventable Injuries

Communicable Diseases

(Cappello, M. A., 2011. Journal of Environmental health, v-73, #7, p. 19)

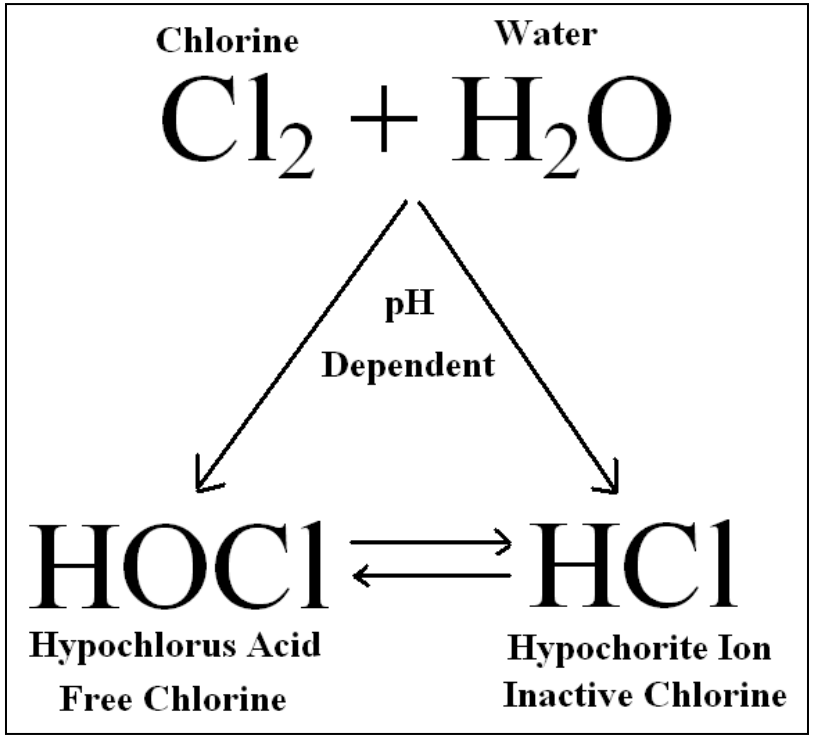
- Between 1978 & 2004 there has been a steady increase in recreational water illnesses.
  - 30,000 illnesses and over 170 outbreaks.

- In Colorado, 2007 was worst year on record.
  - Cryptosporidium outbreaks increased by 400%.

CT = Concentration × Time

- **Amount of time for disinfectant to kill a dangerous organism in the pool water.**

- Assumed that:
  - 1 ppm (1 mg/L) free chlorine at pH 7.5 and 77°F.



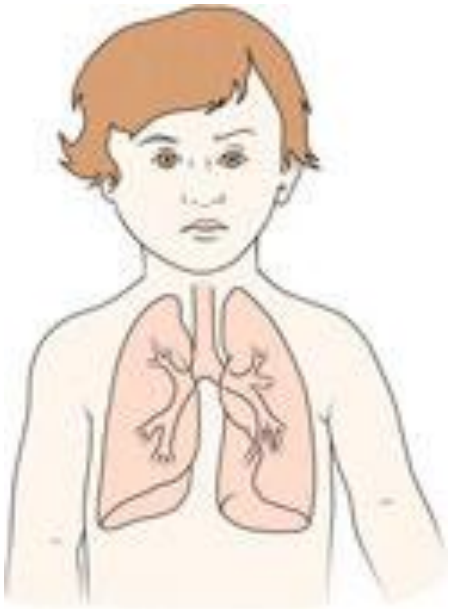
Chlorine Effectiveness

Pathogen	Resistance to Chlorine	Concentration of chlorine	Time of chlorine exposure (min)	CT factor	% Inactivation
E-coli	Low	0.5 mg/L	<0.5	<0.25	99.999999%
Salmonella	Low	0.05 mg/L	20	1	99.2%
Noroviruses	Moderate	1.0 mg/L	0.07	0.07	99.99%
Giardia lamblia	High	1.5 mg/L	10	15	99.9%
Cryptosporidium parvum	High	80 mg/L	90	15,264 *(10.6 days)*	99%

Three Types of Illness:

- Gastrointestinal
  - Stomach

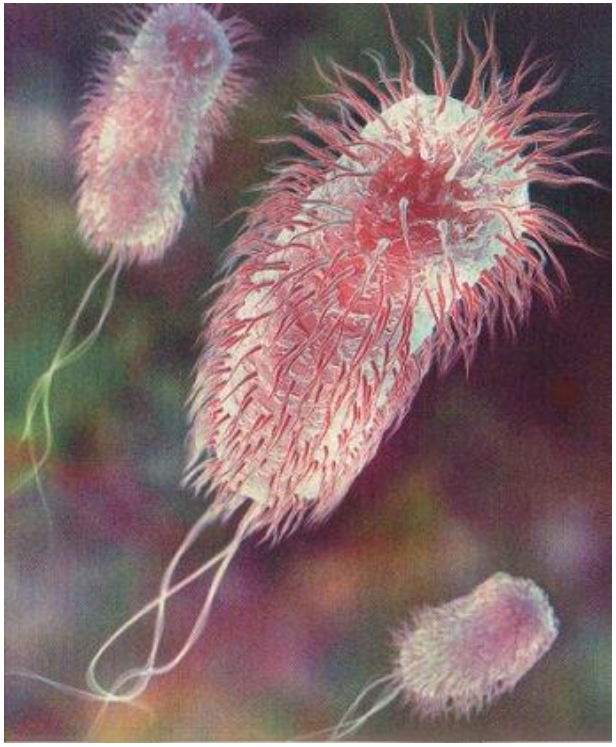
- Respiratory
  - Breathing Problems



- Dermatitis
  - Nasty Rash

E-Coli 0157:H7

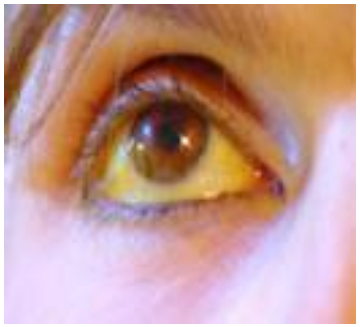
- **Bacteria**
  - Fecal Oral Route
- **Gastrointestinal**
  - Diarrhea
  - Vomit
- **Contact Time:**
  - Less than a minute

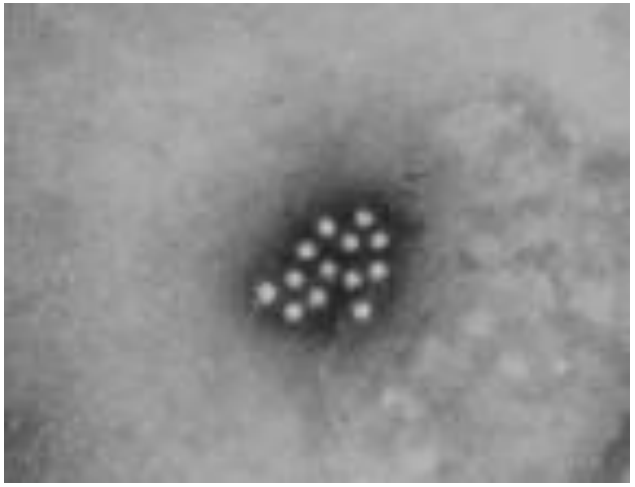


How soon do symptoms appear after exposure?
3-4 days after the exposure, but may be as short as 1 day or as long as 10 days. The symptoms often begin slowly with mild belly pain or non-bloody diarrhea that worsens over several days.

Hepatitis A

- **Virus**
  - Fecal Oral Route
- **Gastrointestinal**
  - Diarrhea
  - Vomit
  - Fever
  - Yellow Skin
- **Contact Time:**
  - Less than a minute





When symptoms occur, how long do they usually last?
Symptoms usually last less than 2 months, although 10%–15% of symptomatic persons have prolonged or relapsing disease for up to 6 months.
What is the incubation period for Hepatitis A?
The average incubation period for Hepatitis A is 28 days (range: 15–50 days).

Gardia

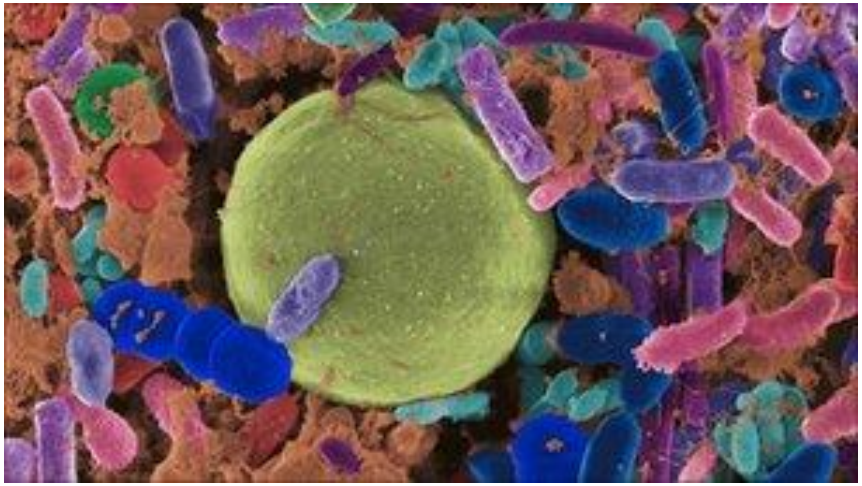
- **Protozoan**
  - Fecal Oral Route
- **Gastrointestinal**
  - Diarrhea
  - Vomit
- **Contact Time:**
  - About 15 - 45 minutes

How long after infection do symptoms appear?
Symptoms of giardiasis normally begin 1 to 2 weeks (average 7 days) after becoming infected.

How long will symptoms last?
In otherwise healthy people, symptoms of giardiasis may last 2 to 6 weeks. Occasionally, symptoms last longer. Medications can help decrease the amount of time symptoms last.

Cryptosporidium

- **Protozoan**
  - Fecal Oral Route
- **Gastrointestinal**
  - Diarrhea
    - Very clear hard to see in the pool water
    - Often people don't even know that they have done it.
- **Contact Time:**
  - 10.6 Days – (15,264 minutes)
    - *New strain may take 20,000 minutes*



"Crypto can stay alive for days even in well-maintained pools. Stopping the germ from getting there in the first place is essential."

- Centers for Disease Control & Prevention (CDC)

Cryptosporidium

Why Should I Be Concerned about Crypto?

Crypto is one of the most common causes of recreational water illness (disease caused by germs spread through pool water) in the United States and can cause prolonged diarrhea (for 1–2 weeks).

It can make anyone sick, but certain groups of people are more likely to become seriously ill when infected with Crypto:

- Young children
- Pregnant women
- Individuals with weakened immune systems

During the past two decades, Crypto has become recognized as one of the most common causes of waterborne illness in the United States. The germ is found in every part of the United States and the world.

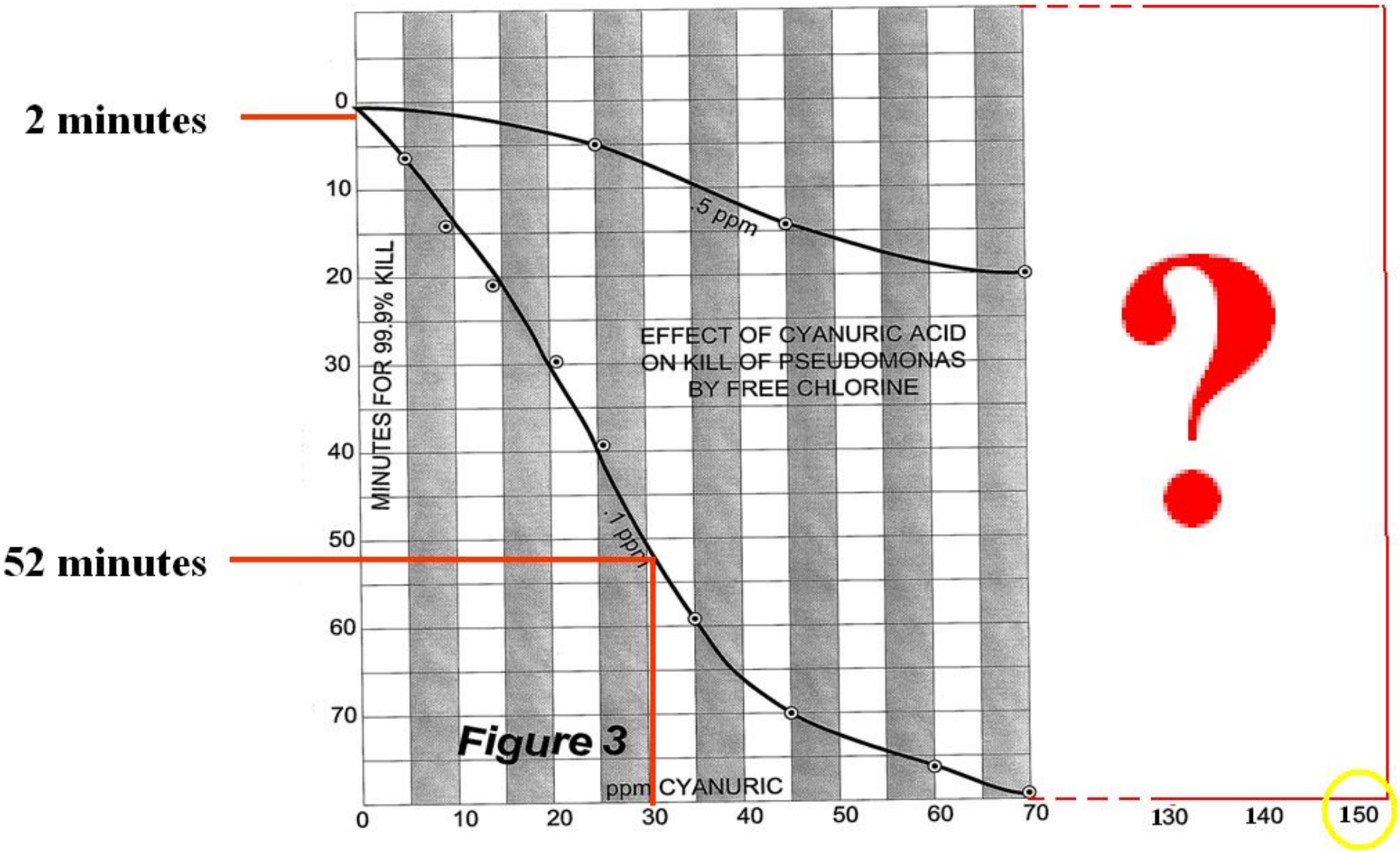
Cryptosporidium & Cyanuric Acid

Raise the free chlorine concentration to 20 ppm[¶,§] and maintain pH 7.5 or less and a temperature at 77°F (25°C) or higher. The free chlorine and pH should remain at these levels for at least 12.75 hours to achieve the CT inactivation value of 15,300.** **Crypto CT inactivation values are based on killing 99.9% of Crypto. This level of Crypto inactivation cannot be reached in the presence of 50 ppm chlorine stabilizer, even after 24 hours at 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C).[††] Extrapolation of these data suggest it would take approximately 30 hours to kill 99.9% of Crypto in the presence of 50 ppm or less cyanuric acid, 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C) or higher.**

Pseudomonas Infection

- **Bacteria**
- **Route:**
  - Contact with contaminated water
- **Dermatitis**
  - Itchy skin
  - bumpy red rash
  - pus-filled blisters that are usually found surrounding hair follicles
  - Eye Infection
- **Contact Time:**
  - 2 minutes
    - *Except when under bio-film*

Pseudomonas Habitat:


2 minutes
52 minutes
MINUTES FOR 99.9% KILL
0
10
20
30
40
50
60
70
.5 ppm
.1 ppm
EFFECT OF CYANURIC ACID
ON KILL OF PSEUDOMONAS
BY FREE CHLORINE
Figure 3
ppm CYANURIC
0
10
20
30
40
50
60
70
130
140
150
?

Pseudomonas Infection

Pseudomonas Infection

Pseudomonas Infection

The incubation period of *pseudomonas aeruginosa* is just 1 to 3 days. *Pseudomonas aeruginosa* can infect any part of the body. The respiratory system, injured bones and joints, urinary tract and the gastric system are the systems of the body, usually affected by these bacteria.

Symptoms of *Pseudomonas Aeruginosa* Infection

The symptoms of *pseudomonas aeruginosa* infection, depends on the part of the body that is infected. Fever, fatigue, muscle and joint pain are symptoms of *pseudomonas bacteremia*. The following list gives the respective symptoms of each infection,

- Bone infection: Swollen infected part, redness.
- Ear infection: Pain in the ear, reduced ability to hear, facial paralysis.
- Eye infection: Pain in the eye, reduced vision, swollen eyelids.
- Cystic fibrosis: Cough, reduced appetite, fast breathing, enlargement of abdomen.
- Skin infections: Ulcer that can result in bleeding.

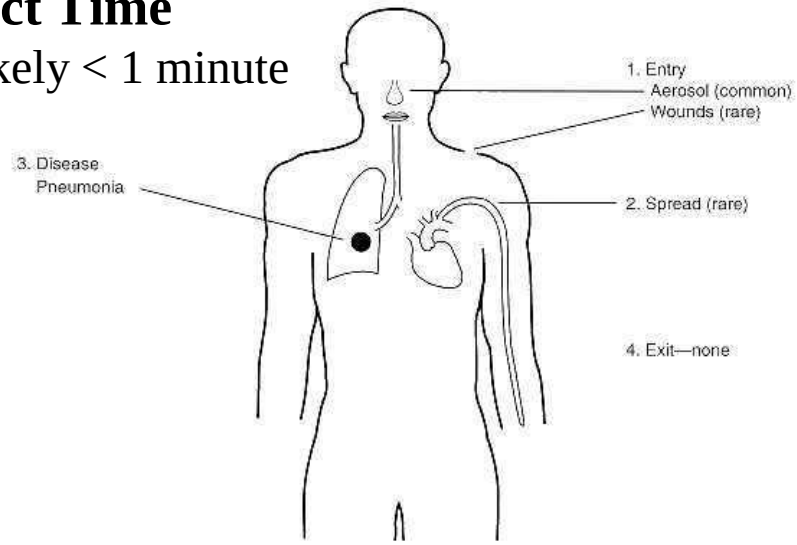
MRSA Infection

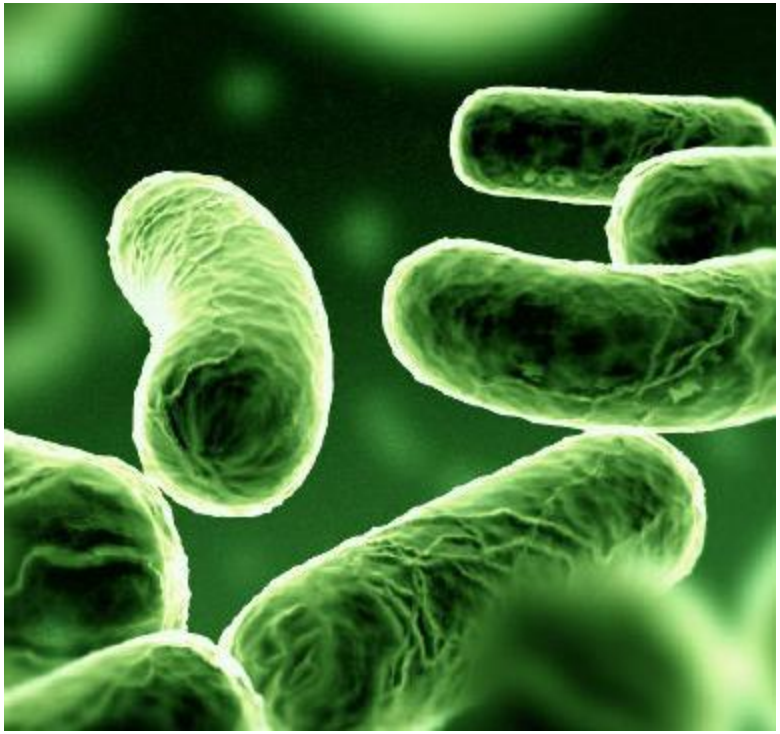
Methicillin-resistant Staphylococcus aureus

- **Bacteria**
  - *Staphylococcus*
- **Route**
  - Direct and Indirect skin contact:
    - Touching, sharing towels, sharing pools, sharing exercise equipment, etc.
- **Dermatitis**
  - Infected cuts
  - Boils
  - Infected hair follicles
  - Fluid filled blisters (impetigo)
  - Skin sores that look like insect bites
- **Contact Time**
  - 1-2 minutes

Legionella Infection

- **Bacteria**
  - Legionella
- **Route**
  - Person to Person
  - Breath contaminated mist or steam
  - Plumbing Systems
- **Pneumonia**
  - Legionellosis
- **Contact Time**
  - Likely < 1 minute





The swelling and irritation (inflammation) of the membranes covering the brain.

Echovirus - Aseptic Meningitis

- **Viral**
  - Echovirus
- **Route**
  - Person to Person
  - Correlated with head submersion
- **Contact Time**
  - Likely < 1 minute

"…Increasing frequency of submerging one's head in the campground pool during the outbreak period was associated with increased risk for primary illness of either case type (age-adjusted OR = 3.3 for one--five times, 5.9 for six--15 times, 6.1 for >16 times; p<0.05). Campers reported that the pool often was crowded at midday (e.g., "wall-to-wall" swimmers), particularly during weekends. An automated chlorine feeder with stabilized cyanurated chlorine was in use at the pool throughout the day. Chlorine levels were checked twice a day (i.e., at approximately 7 a.m. and 8 p.m.) with a handheld test kit. According to written records, chlorine levels were low (0.5--1.0 mg/L versus the required level of >1.5 mg/L) almost every evening throughout late July and August. The pool operator was not certified by a national certification group…"

- Aseptic Meningitis Outbreak Associated With Echovirus 9 Among Recreational Vehicle Campers,2003 – (CDC website)

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Published: 11/01/2011 08:00

Burton family to sue over holday from hell

by HELEN KREFT

A FAMILY of four from Burton are among a group of 107 tourists who are suing a holiday company after a holiday from hell.

Sarigerme Holiday Village in Dalaman, Turkey

The family, who have not been identified but who are from Norfolk Road, Stapenhill, are among a group who have launched a High Court claim for unlimited damages which, if combined could top the £1 million mark if successful, after becoming ill on holiday in Turkey.

A writ issued at London's High Court and just made public claims that their holidays were ruined when they came down with salmonella and other gastrointestinal diseases after staying at the allinclusive Sarigerme Holiday Village in Dalaman, Turkey, in 2009.

Now they are suing First Choice Holidays and Flights.

The writ says that the company has already accepted liability for negligence of its "suppliers'."

The claimants say they were struck down with tummy bugs, including

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CHESTER-LE-STREET NEWS

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Family sues over illness on holiday

9:14am Tuesday 11th January 2011

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By Gavin Havery »
Reporter (Derwentside & Tyneside)

A FAMILY break to come to terms with the death of a loved one turned into a holiday from hell after members of the party contracted food poisoning on the first day.

Retired fitter George Slater, from Ouston, near Chester-le-Street, was devastated after he lost his wife, Ann, in May 2009.

So he decided to treat his daughter, Donna-Marie Ferris, her husband Lee – who has since

LEGAL ACTION: George Slater and his daughter, Donna-Marie Ferris, who both got food poisoning while on holiday in Turkey

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Consumer reports insights

Health clubs can be unhealthy

Tuesday, December 21, 2010

Joining a health club can make it easier and more fun to exercise. But gyms can also present safety problems. Bacteria in poorly maintained pools can spread disease. Antibiotic-resistant staph infections can be picked up in crowded locker rooms and from heavily used exercise equipment. You can be injured or even suffer an exercise-related heart problem. Here's how to minimize those risks.

(Laughing Stock/corbis)

Enlarge Photo

Skin infections

Staph infections, including those caused by methicillin-resistant *Staphylococcus aureus* (MRSA) bacteria, can spread through shared gym equipment, mats and towels. Infections tend to occur near a cut or scrape, and on certain

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In Some Swimming Pools, a Nasty Intestinal Parasite

By SARAH ARNQUIST
Published: June 15, 2009

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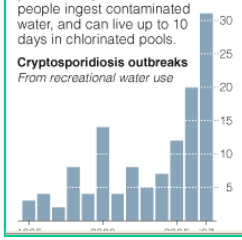
THE TREE OF LIFE SUMMER

A swimming pool can offer relief from summer heat, but swimmers should know what they are jumping into. It could be a soup of nasty parasites.

Something in the Water

Reports of gastrointestinal illness from cryptosporidum have risen sharply in recent years. The parasite is spread when people ingest contaminated water, and can live up to 10 days in chlorinated pools.

Cryptosporidiosis outbreaks
From recreational water use

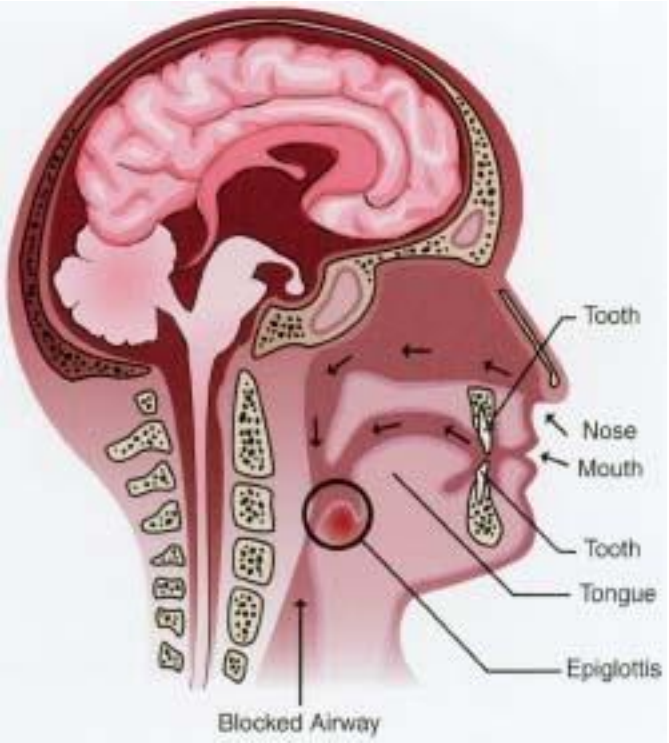


Reports of gastrointestinal illness from use of public pools and water parks have risen sharply in recent years, according to the Centers for Disease Control and Prevention. The leading culprit is a microscopic organism that lives in human feces.

Called cryptosporidium, it is a parasite transmitted in an egglike shell that can survive as long as 10 days even in chlorinated water. In 2007, the last year for which statistics are available, it was responsible for 31 recreational water outbreaks involving 3,726 people, according to the disease centers — up from 7 outbreaks and 567 people in

Chemical Caused Respiratory Illness

- Chemical *epiglottitis*
  Laryngotracheobronchitis
  – *Combined Chlorine*



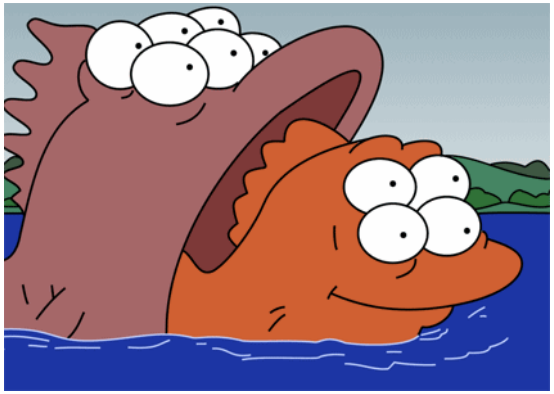
In 2006, a 6 year old boy was hospitalized after spending 3 hours swimming in an indoor pool with a 4.2 ppm Combined Chlorines concentration.

Other Illness

- Mutation
  - *Disinfection-By-Products*
    - *Trihalomethanes*
      - *Brominated Trihalomethanes - Enter through skin and lungs.*
        - *MCL for drinking water = 0.080 mg/l (ppm)*

"…Swimmers need to be more aware of their personal hygiene." Taking bathroom breaks, for instance, would "improve swimmer health tremendously," he maintains. The reason: "The urea in urine reacts with chlorine to produce some of these disinfection by-products. In fact," he notes, "it's the constituents of human sweat and urine that are largely responsible for their formation."

- Ernest Blatchley III of Purdue University in West Lafayette, Ind.



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Health News

Swimming pool disinfectants linked to cancer

Swimming pools can give you cancer, because disinfectants in the water react with sunscreen, sweat, and skin to form a toxic cocktail of chemicals, a study has suggested.

Chemicals in pools can combine to create a health risk Photo: ALAMY

4:45PM BST 22 Jul 2010

The disinfectant used to keep pool water free from disease can also react with swimmers' urine and hair to cause conditions including asthma and bladder cancer.

Products like sunscreen and oil are packed with nitrogen, which reacts with the disinfectant to create toxic chemicals capable of mutating genes.

These mutations contribute to birth defects, accelerate the ageing process, cause breathing problems, and even induce cancer after long-

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FAMILY HEALTH

Chlorinated Pools May Contribute to Asthma and Respiratory Allergies

By Madeline Ellis
Published: Tuesday, 15 September 2009

Asthma is the leading cause of chronic illness in children, affecting as many as 9 million children in the United States; a number that has dramatically increased over the past two decades. And though no one really knows why more and more children are developing the disease, there are a number of theories. Some experts suggest the increase may be due to limited access to care, especially those living in inner-city neighborhoods, and to poor asthma management and education. Others say children aren't exposed to enough childhood illnesses to build up their immune system. Still others suggest that, because today's kids spend more time indoors than before, they are increasingly exposed to asthma-triggering allergens, such as dust mites and polluted air. But researchers in Belgium propose another explanation for the 86.8 percent spike in asthma among children since 1982—chlorinated swimming pools.

For their study, Alfred Bernard, a toxicology professor at Catholic

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Operator Injuries

- Burns from pool chemicals
  - Mixing
  - Splash
  - Dust from powder
- Fire
  - Some chemicals ignite when mixed
- Gas
  - Cl_2

Read The label!

Bad Chemical Storage:

Operator Injuries

- Do you have MSDS Sheets for all chemicals in the facility?
- Are you OSHA compliant with a Personal Protective Equipment (PPE)?
- Call your insurance company and/or OSHA representative.

Any Questions?

Understanding:
Oregon Laws & Rules

- **ORS: 448.005 – 448.090 (Statute)**
  - http://www.leg.state.or.us/ors/448.html

- **OAR: 333-60-0000 (Pool Code)**
  - http://www.oregon.gov/DHS/ph/pl/docs/pool07.pdf

- **OAR: 333-062-0000 (Spa Code)**
  - http://www.oregon.gov/DHS/ph/pl/docs/sparulesnewest.pdf

Sanitation Inspections

- **Semi-annual**
  - Check all aspects of the pool and operation
- **Re-check Inspections**
  - May come with a fee
  - Verify that corrections have been made
- **Closure**
  - If an irresolvable problem exists, or there is evidence of negligent management, the pool and/or spa will be ordered closed.
    - You cannot re-open until approved by the Health Department

Penalties

448.990 Penalties *for violations of pool facility or water system requirements. (1) Violation of ORS 448.005 to 448.090 by any person, firm or corporation, whether acting as principal or agent, employer or employee, is a Class B misdemeanor. Each day that the violation continues is a separate offense.*

Class B misdemeanor *= Max: 6 months in jail and/or $2500.00 fine.*

Federal Model Pool Code

CDC Home

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Healthy Swimming/Recreational Water

Healthy Swimming & Recreational Water Home

- **Model Aquatic Health Code**
- News
- Steering Committee
- Technical Committees
- MAHC Modules for Review

Healthy Water Home

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- Healthy Swimming / Recreational Water
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More »

CDC.gov > Healthy Water Home > Healthy Swimming & Recreational Water Home

Model Aquatic Health Code (MAHC)

CDC, through an initial grant from the National Swimming Pool Foundation, is working with public health and industry representatives across the United States to build a Model Aquatic Health Code (MAHC). The MAHC will serve as a model and guide for local and state agencies needing guidance to update or implement standards governing the design, construction, operation, and maintenance of swimming pools and other treated recreational water venues. To review MAHC modules, click here.

On This Page

- MAHC News
- Background
- MAHC Process
- Organization of MAHC Effort
- Information and Assistance

MAHC News & Announcements

Previous MAHC News & Announcements

All Model Aquatic Health Code (MAHC) Technical Committees have been established. However, those interested in the MAHC project can still provide input into the process by commenting on the draft model code language that will be posted on this website. We welcome all comments and suggestions.

Occasionally, a member of the Technical Committee can no longer participate and must be replaced. Persons interested in being considered for committee membership in the event of a replacement may visit the Technical Committees page to view and submit the application form for technical committee membership.

Top of Page

Background

In the United States, there is no federal regulatory authority for disinfected recreational venues; all pool codes are developed, reviewed, and approved by state and/or local public health officials. As a result, there are no uniform, national standards governing the design, construction, operation, and maintenance of swimming pools and other treated recreational water venues.

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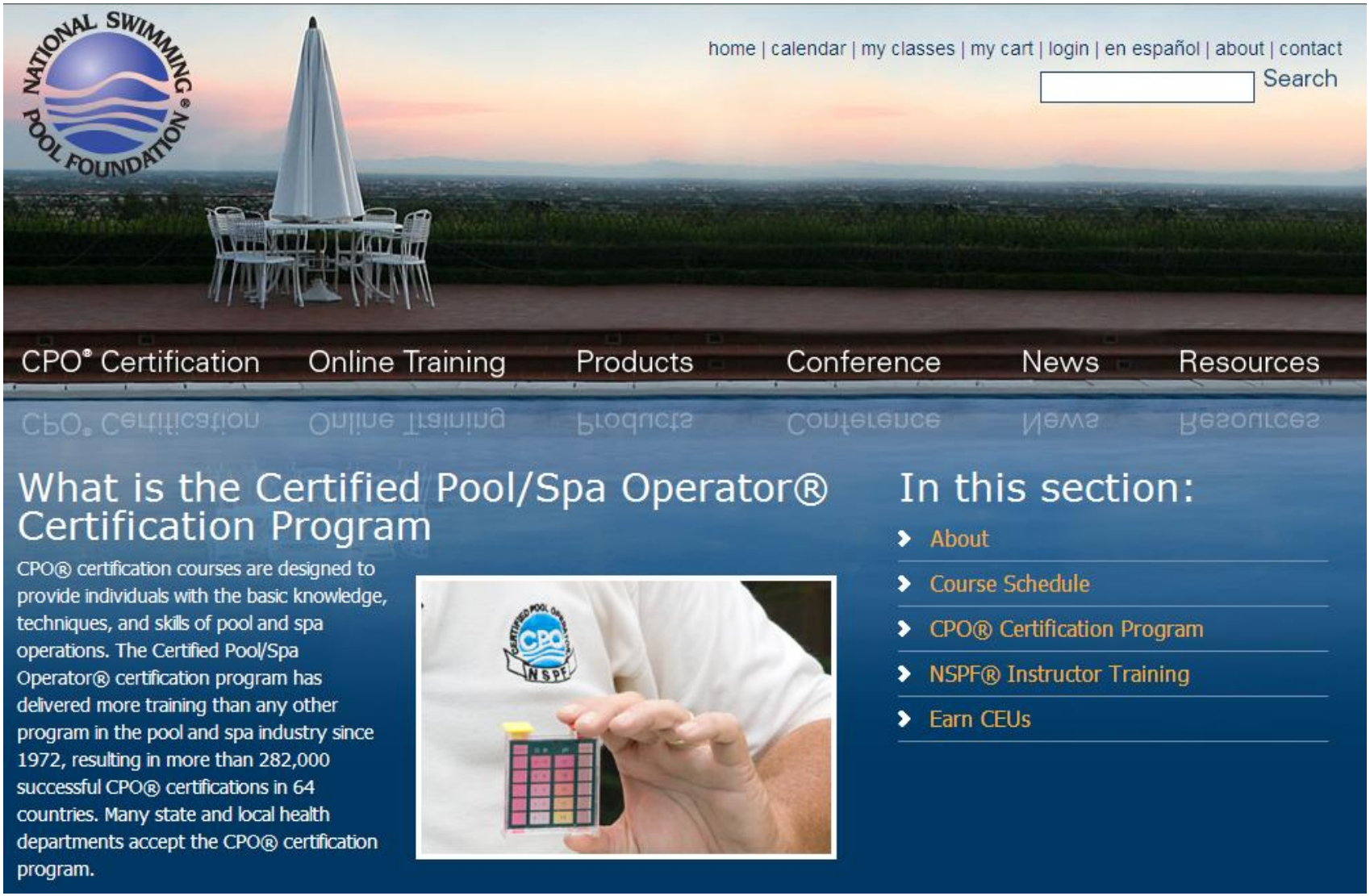


http://nspf.org/en/cpo.aspx

Oregon Class Schedule

City	Start Date	End Date	Course Type	Contact	Email	Website	Phone	Alt. Phone
Beaverton	03/14/2013	03/15/2013	English	Phil Oaks	propools73@gmail.com		360-241-7665	
Bend	05/08/2013	05/09/2013	English	John Mason	poolschooloregon@q.com		541-610-8818	541-388-6598
Hillsboro	04/25/2013	04/26/2013	English	Lori Mason	lorim@ci.hillsboro.or.us	http://www.ci.hillsboro.or.us/ParksRec	503-615-6527	503-681-6127
Jantzen Beach	05/09/2013	05/10/2013	English	Phil Oaks	propools73@gmail.com		360-241-7665	
La Grande	04/10/2013	04/11/2013	English	John Mason	poolschooloregon@q.com		541-610-8818	541-388-6598
Oregon City	04/23/2013	04/25/2013	English	John Mason	poolschooloregon@q.com		541-610-8818	541-388-6598
Portland	04/16/2013	04/17/2013	English	Bill Sexton	billsexton@bestaquatic.com	http://www.BestAquatic.com	443-614-4789	302-853-5358
Sunriver	04/25/2013	04/26/2013	English	Joe Andrews	sales@lincolnaquatics.com	http://www.lincolnaquatics.com	800-223-5450	

2-Day Classroom Course

Classroom CPO® Certification

The CPO® certification program can be taken as a two-day class that covers 14-16 hours of information from the NSPF® Pool & Spa Operator™ Handbook and local codes taught by a certified NSPF® Instructor. This dynamic setting offers direct interaction with an instructor and fellow students. Pass the open book exam and earn CPO® certification.

Things we can help you with:

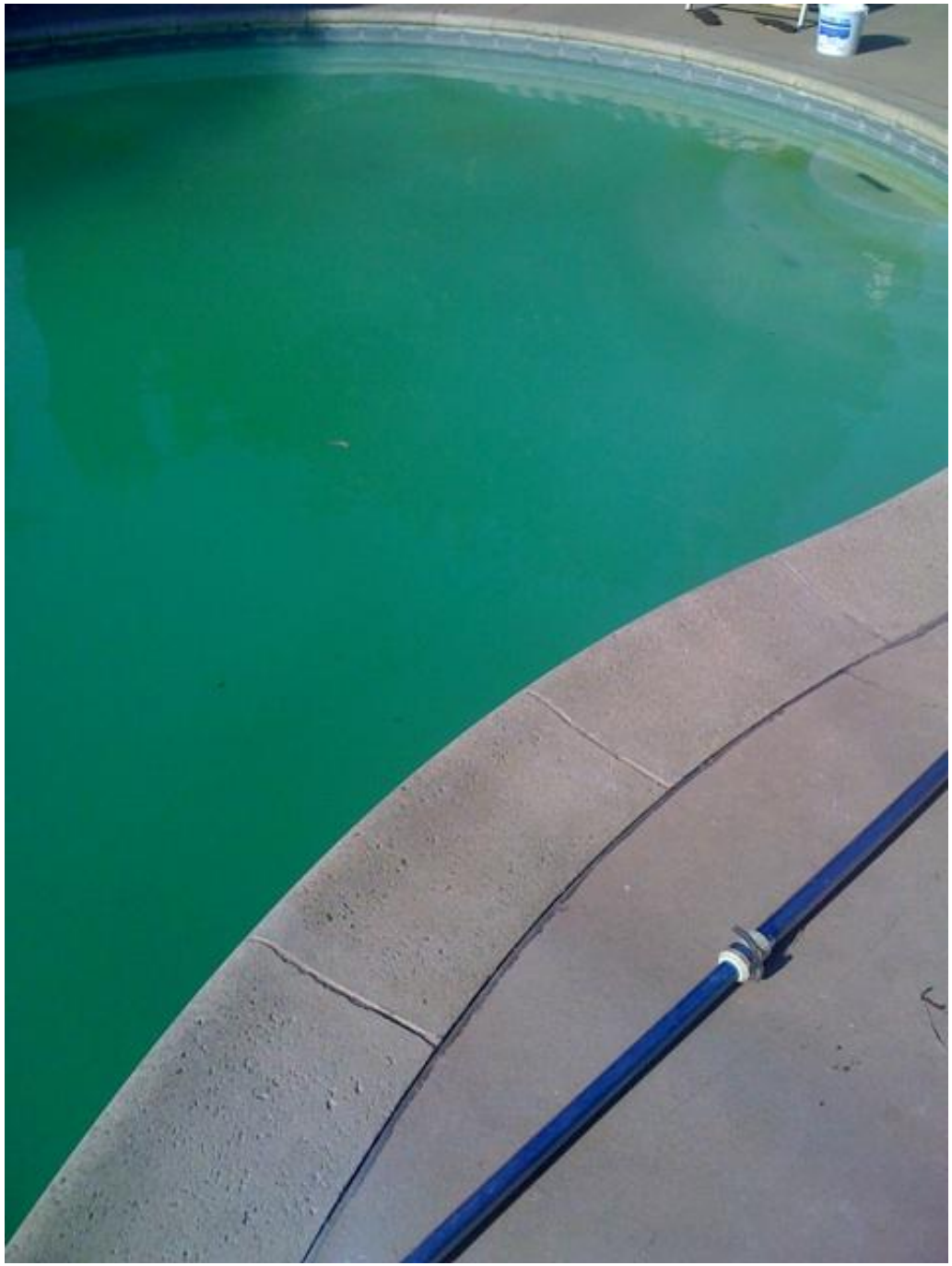
- Calculating pool chemical dosage.
- Editing and critiquing operating and emergency procedures.
- Identifying risk at your facility.
- Technical assistance.
- Protection from liability.
  - *Assuming compliance with rules*

The End

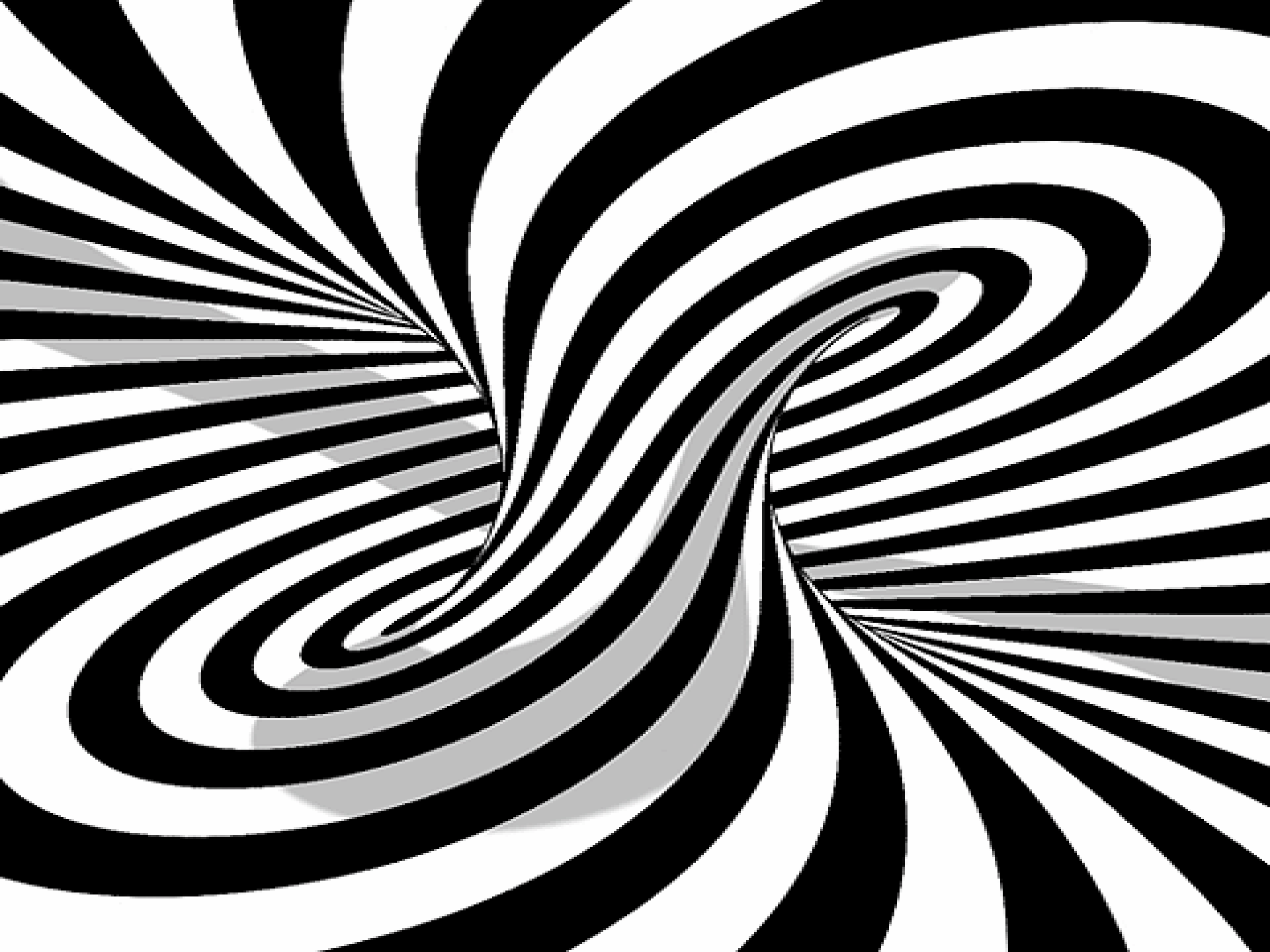
Any Questions?

Snapshots at jasonlove.com

"Is it just me, or does this water feel unnaturally warm?"



Bather Load?

New York Dumpster Pool

Natural Human Behavior?